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VOL. CXXXIII.—No. 3470] LONDON: FRIDAY EVENING, JUNE 30, 1922 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The High Commissioner for India is prepared to receive TENDERS for the SUPPLY of :—

1. BRIDGE WORK, DECK SPANS.
2. LOCOMOTIVE ENGINES AND TENDERS.

Forms of Tender may be obtained from the Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Tuesday, the 18th July, 1922, for No. 1, and on Friday, the 21st July, 1922, for No. 2.

T. RYAN,
Director-General.
8619

Finsbury Technical College,
LEONARD-STREET, CITY-ROAD, E.C. 2.
Dean for the Session 1921-22 :
Professor W. H. ECCLES, D.Sc., F.R.S.

The College provides practical scientific training for students who desire to become Civil, Mechanical or Electrical Engineers, or Chemists.

Candidates are required to pass an Entrance Examination in Mathematics and English, but the Matriculation Certificate of any British University and certain other qualifications are accepted in lieu of it. The next ENTRANCE EXAMINATION will be held on TUESDAY, SEPTEMBER 19th. Applications for admission should be forwarded to the College on forms to be obtained from the REGISTRAR. The programme of the College is under revision and will be issued shortly. 8468

University of Cape Town.

DE ARTMENT OF CIVIL ENGINEERING.

WANTED by 1st October, or as soon after as possible, a FIRST-GRADE MECHANICAL ASSISTANT in the CIVIL ENGINEERING LABORATORY.

Applicants must be good mechanics, and have had satisfactory workshop experience. The duties of the position are to work and repair the testing and hydraulic equipment in the laboratory, to lay down new plant, to make test specimens and accurate experimental apparatus, and, generally, to work under the instructions of the Professor. Experience in turning, fitting, and fine instrument work is essential.

Salary £350 a year, rising to £450 by annual increments of £25.

The appointment is probationary for the first two years.

An allowance of £40 will be made for passage money; pension rights are secured under the Government Teachers' Superannuation Fund, membership of which is compulsory; six months' leave of absence may be granted after six years' service, three months of which will be on full pay.

Applications, in triplicate, should be sent to the SECRETARY, Office of the High Commissioner for the Union of South Africa, Trafalgar-square, London, not later than 15th July, 1922. 8627

University of Glasgow.
CHAIR OF MINING.

The University Court proposes to consider the making of an APPOINTMENT to FILL the VACANT CHAIR on 21st July next or later date.

Information regarding the Chair may be obtained on application to the SECRETARY of the UNIVERSITY COURT, the University, Glasgow.

June, 1922. 8583

County Borough of Halifax.
HALIFAX CORPORATION ELECTRICITY DEPARTMENT.

The Tramways and Electricity Committee of the Halifax Corporation have FOR SALE the following PLANT :—

2 Babcock and Wilcox WATER-TUBE BOILERS, complete with Chain-grate Stokers.
1 TANDEM COMPOUND STEAM FEED WATER PUMP (J. F. Hall and Son's make).

The above can be inspected by arrangement, and full particulars may be obtained on application to Mr. W. M. Rogerson, M.I.E.E., Borough Electrical Engineer, 29, Northgate, Halifax.

Tenders for the above plant should be delivered to the Town Clerk, Town Hall, Halifax, not later than Saturday, 8th July, 1922.

The highest or any Tender not necessarily accepted.

By Order,
PERCY SAUNDERS,
Town Clerk.

Town Hall, Halifax,
16th June, 1922. 8441

Goole Urban District Council
(GAS AND WATER DEPARTMENT).
PUMPING PLANT, &c.

The above Council invite TENDERS for a PLANT capable of pumping 50,000 gallons of water per hour from a proposed 36in. bore-hole at their Pollington Waterworks to the Water Tower at Goole.

And alternatively TENDERS for SINKING a BORE-HOLE 420ft. deep in their No. 2 Well and PROVIDING and FIXING a BORE-HOLE PUMP with a capacity of 50,000 gallons per hour; also for a WATER TOWER at Goole with a capacity of 750,000 gallons and the bottom of the tank or tanks thereof 120ft. above the ordinary top water level of the Knottingley and Goole Canal; also for DEEPENING Nos. 1 and 2 WELLS and the ADITS between Nos. 1, 2 and 3 WELLS, and ALTERING the existing PUMPS to lift from a greater depth.

Further particulars may be obtained from the undersigned.

ARTHUR F. YATES,
Engineer and Manager.

Gasworks, Doyle-street, Goole,
21st June, 1922. 8569

London County Council.

TENDERS are INVITED for the MANUFACTURE, SUPPLY, DELIVERY, ERECTION, TESTING and MAINTENANCE of FOUR ELECTRIC LIFTS for the Council's Tramways Central Repair Depot, Charlton, S.E.

The specification, form of Tender and other particulars may be obtained from the Clerk of the Council, County Hall, Westminster Bridge, S.E. 1, on payment to the Cashier of the Council of a deposit of £2, which amount will be returnable on receipt of a bona fide Tender which is not withdrawn. Particulars of the work may be obtained on application at the County Hall before payment of this fee.

Tenders must be addressed to the Clerk of the Council and delivered at the County Hall, Westminster Bridge, S.E. 1, not later than 4 p.m. on Monday, 31st July, 1922. No Tender received after that time will be considered.

The Council does not bind itself to accept the lowest or any Tender.

JAMES BIRD,
Clerk of the London County Council.
8571

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Electrification of Chilean Railways.

Chinese Engineering Notes.

Institution of Mechanical Engineers: Visit to France and Belgium.

Report on Automatic Train Control.

The "Civils'" Conversazione.

Recent Developments in Power Station Design.—XXXV.

Municipal Electrical Association.

Charging Machine for Cupolas.

New Coal Shipping Appliances at Maryport.

Large All-geared Double-bedded Lathe.

PUBLIC NOTICES

Newport (Mon.) Corporation
WATERWORKS.
TALYBONT SCHEME.—CAST IRON PIPES.
CONTRACTS NOS. 1 AND 2.

The Waterworks Committee invite TENDERS for the SUPPLY of CAST IRON PIPES in two Contracts as follows :—

No. 1.—About 11,000 Tons, 25in. in diameter, and a small quantity of lesser diameters.
No. 2.—About 11,000 Tons, 25in. and 19in. in diameter, and a quantity of other sizes.

Separate specifications and forms of Tender may be obtained and drawings inspected at the office of the Engineers, G. H. Hill and Sons (Westminster), 3, Victoria-street, Westminster, on payment of £2 in each case, which will be refunded to the applicant provided he shall have sent in a bona fide Tender, shall not have withdrawn the same, and shall have returned the documents and drawings lent to him. The said sum will also be returned to any applicant who decides not to tender, if the documents and drawings are returned within a week of their issue to him. A limited number of sets of the drawings are available for lending to persons who have applied for the specifications, and will be lent to such persons in priority of application on payment of the sum of One Pound for each set, which sum will not be returned.

Separate sealed Tenders, endorsed "Talybont Scheme, Tender for Contract No. 1" or "No. 2," as the case may be, and addressed to the undersigned, must be received not later than Saturday, the 22nd July.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will be required to pay trades union rate of wages and observe the recognised hours and rules of labour.

ALBERT A. NEWMAN,
Town Clerk.

Town Hall, Newport, Mon.,
26th June, 1922. 8594

Newport (Mon.) Corporation
WATERWORKS.
TALYBONT SCHEME, CONTRACT NO. 3.
VALVES, BRIDGE WORK, &c.

The Waterworks Committee invite TENDERS from experienced makers of valves for waterworks purposes for the SUPPLY of AUTOMATIC STOP VALVES, SLUICE VALVES, AIR VALVES, REFLUX VALVES, REDUCING VALVE, FLAP VALVES, and MISCELLANEOUS IRONWORK, also SMALL BRIDGE WORK, all in connection with a line of piping chiefly 25in. in diameter and about 34 miles in length. The bridge work may be sublet. Specification and form of Tender may be obtained and drawings inspected at the office of the Engineers, G. H. Hill and Sons (Westminster), 3, Victoria-street, Westminster, upon payment of Two Pounds, which will be returned to the applicant provided that he shall have sent in a bona fide Tender, and shall not have withdrawn the same, and shall have returned the documents and drawings lent to him. A limited number of sets of the drawings (uncoloured) are available for lending to persons who have applied for the specification, and will be lent to such persons in priority of application on payment of the sum of Two Pounds, which sum will not be returned. Sealed Tenders, endorsed "Talybont Scheme, Tender for Contract No. 3," and addressed to the undersigned, must be received by me not later than Saturday, the 22nd July.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will be required to pay trades union rate of wages and observe the recognised hours and rules of labour.

ALBERT A. NEWMAN,
Town Clerk.

Town Hall, Newport, Mon.,
26th June, 1922. 8595

WANTED, Bound or Unbound, VOLUMES of "THE ENGINEER" from July, 1914, to June, 1919.—Address, stating lowest price, P1000, The Engineer Office. P1000 I

PUBLIC NOTICES

State Electricity Commission
OF VICTORIA.
TENDERS FOR PLANT.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Morwell Power Scheme.

Copies of Tender form and specification will be available upon application to—

Agent-General for Victoria,
Melbourne-place, Strand,
London, W.C. 2.

SPECIFICATION NO. 261.—STRAIN and PIN TYPE INSULATORS.

CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract, specification and drawing complete. These charges will be returned on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each.

PRELIMINARY DEPOSIT.—A preliminary deposit of £100 is to be lodged with Tender.

The specifications may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on prescribed forms, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than Noon, 16th September, 1922.

R. LIDDELOW,
Secretary,
State Electricity Commission of Victoria,
Melbourne, Victoria, Australia.
8590

Bombay Municipality.

REQUIRED, ONE MECHANICAL ENGINEER and THREE ASSISTANT MECHANICAL ENGINEERS, to Supervise the Manufacture of 72in., 60in., and 57in. diameter Steel Pipes in the Workshops near Bombay, and the Assembling and Laying of the same along 60 miles of pipe track outside Bombay.

All applicants should be between 35 and 45 years of age.

The Mechanical Engineer should have had a good technical education and considerable practical experience in structural steel work, boilermaking, &c., and have held a responsible position as works manager, shift engineer, or similar post in a shipyard, railway, or large commercial firm.

Assistant Engineers should have had similar experience in a less responsible position, such as works foreman or foreman boilermaker, &c.

The salary for the Mechanical Engineer is Rs. 1500 per month, without quarters. The salary for the Assistant Engineer is Rs. 800 per month, with rent or quarters and simple furniture; no accommodation is provided for wife or family.

All the appointments are temporary, but are not expected to terminate within three years.

The salary will commence from date of joining appointment in Bombay, and single first-class rail fare to Bombay will be paid to applicants selected from India.

Single first-class P. and O. passage from London to Bombay for the Mechanical Engineer, and second-class P. and O. passages for the Assistant Engineers will be provided if applicants are selected from the United Kingdom, with half salary on voyage.

Similar return passages and half salary on voyage being allowed on satisfactory completion of their duties.

All appointments are subject to three months' notice on either side.

All selected candidates will be required to furnish a medical certificate of sound health and constitution prior to engagement. They will be entitled to leave according to the Municipal Leave Rules.

Selected candidates will be required to enter on their duties in Bombay early in December, 1922.

Applications, stating age, qualifications and experience, together with copies of testimonials, should be addressed to the undersigned and will be received up to 31st August, 1922.

H. J. TRIVESS SMITH, M.I.C.E.,
Hydraulic Engineer.
C/o Messrs. Henry S. King and Co.,
9, Pall Mall, London, S.W. 1.
8573

PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
GEAR-CUTTING APPARATUS.

The Proprietors of British Letters Patent No. 18,658 of 1914 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It relates to the machinery for cutting curved or so-called spiral teeth, particularly on bevel gears.

Address :
B. W. & T.,
111/112, Hatton-garden,
8620 London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
HEATING STOVES.

The Proprietor of British Letters Patent No. 120,212 is PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work thereunder. It relates to domestic heating stoves for burning sawdust, in which air enters below a stepped grate at the bottom of an air-tight receptacle and the distillation gases pass downwardly through the fuel and burn under the grate.

Address :
B. W. & T.,
111 and 112, Hatton-garden,
8621 London, E.C. 1.

The South Indian Railway Company, Limited, are prepared to receive TENDERS for the SUPPLY of :—

1. FIRE-BRICKS AND FIRE-CLAY.
2. HELICAL SPRINGS.
3. SPRING STEEL.
4. ROLLING STOCK.
5. BRASS AND COPPER TUBES AND SHEETS.
6. BUFFERS FOR BROAD-GAUGE WAGONS.
7. METALS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tenders for Fire-bricks and Fire-clay," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 14th July, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specifications Nos. 1, 2, 3, 4 and 5, and £1 for each copy of Specifications Nos. 6 and 7.

Copies of the drawings may be obtained at the office of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1.
28th June, 1922. 8642

London County Council.

REQUIRED in September next, at the School of Building, Brixton, a VISITING TEACHER of HEATING and VENTILATING, for one evening a week. Fee 20s. Technical experience essential, teaching experience an advantage.

Preference given to candidates who have served or attempted to serve with H.M. Forces. Apply, Education Officer (T.1A), County Hall, Westminster Bridge, S.E. 1 (stamped addressed foolscap envelope necessary), for form of particulars, to be returned by 10th July, 1922. Canvassing disqualifies.

JAMES BIRD,
8630 Clerk of the London County Council.

Metropolitan Water Board.
TEMPORARY CIVIL ENGINEERING AND ARCHITECTURAL DRAUGHTSMEN.

The Metropolitan Water Board REQUIRE the SERVICES of a thoroughly experienced, neat and expeditious CIVIL ENGINEERING DRAUGHTSMAN, accustomed to the preparation of drawings in a waterworks undertaking. They also REQUIRE a thoroughly competent and experienced ARCHITECTURAL DRAUGHTSMAN. The appointments will be held during the pleasure of the Board, at inclusive salaries at the rate of £350 per annum each. Applications, stating age and particulars of experience, may be sent to "The Clerk of the Board, Metropolitan Water Board, 173, Rosebery-avenue, E.C. 1," not later than Saturday, 8th July, 1922, endorsed "Civil Engineering, or Architectural, Draughtsman" (as the case may be). Candidates selected for interview will be required to produce specimens of their work. The appointments are determinable by one month's notice on either side, but without prejudice it is expected that the engagements will continue for a year.

W. MOON,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1
23rd June, 1922. 8606

The National Foremen's Association of the ENGINEERING AND ALLIED TRADES,
(Registered under the Trade Union Act.)
An Association specifically formed to look after the interests of Foremen in their Supervisory Capacity.
All communications to Head Offices,
H. W. REID, 95, Belgrave-road,
General Secretary. Victoria, S.W.1
Ex.

PUBLIC NOTICES (continued) Page II.

SITUATIONS OPEN, Page II.
SITUATIONS WANTED, Page II.
PATENTS, Page III.
MACHINERY, &c., WANTED Page III.
FOR SALE, Pages III. and IV.
AUCTIONS, Pages IV. and C.
PREMISES TO LET OR WANTED Page IV.
WORK WANTED, Page IV. and VIII.
AGENCIES, Page II.
MISCELLANEOUS, Page II.

For Advertisement Rates See Page 723, col. 1.

NUMERICAL INDEX TO ADVERTISEMENTS, Page XCIX.

PUBLIC NOTICES

Singapore, Straits Settlements.
WATER DEPARTMENT.
ASSISTANT SUPERINTENDENT OF WATER MAINS AND SERVICES.

The Municipal Commissioners of Singapore REQUIRE an ASSISTANT SUPERINTENDENT of WATER MAINS and SERVICES, age about 27 to 33 (preferably unmarried), on a three years' agreement, with possible extension. Applicants must have had a good education, be well trained and have had special practical experience in the laying of water mains and outside water fittings, as well as internal plumbing. They must be "Registered Plumbers," with experience in the work of a mains and services department under a water authority in the United Kingdom, and must be accustomed to carrying out the model by-laws and regulations. They should be accustomed to controlling men, and experience in a workshop and in training men will be an advantage, as the successful candidate would be required to instruct the native subordinate staff in the practice and requirements of modern internal plumbing for public and private buildings. He would also be required to supervise such work in accordance with standard regulations, whether executed by outside contractors or by municipal workmen. A bonus of 50 dollars will be given on the selected candidate's passing successfully an examination in colloquial Malay within twelve months of his arrival in Singapore. Salary 4560 dollars for the first, 5040 dollars for the second, and 5520 dollars for the third year, paid monthly in dollars the currency of the Colony, the value of the dollar being two shillings and fourpence sterling. In addition there is a temporary allowance of 15 per cent., which may be reduced or abolished at any time. If re-engaged, the candidate, in his fourth year, would probably be placed in Class 5 of the salary scheme, at a commencing salary of 6000 dollars per annum (£700), rising by annual increments of 480 dollars to 7440 dollars (£868) per annum, with any temporary allowance that might then be in force. The pay of the appointment for the first year at the above rate would be about £611. Such local transport allowance as may from time to time be sanctioned by the Commissioners will be paid. Free second-class passage will be provided, with half-pay during the voyage out. The selected candidate must pass a medical examination. Applications, stating whether married or single, age and place of birth, and giving details of education, apprenticeship, training, and experience generally, with war service, and referring to the above requirements in detail, accompanied by copies (only) of testimonials, also personal references, are to be lodged with Messrs. C. C. LINDSAY and PEIRCE, MM. Inst. C.E., 180, Hope-street, Glasgow, Agents to the Commissioners (who will give further particulars if requested), not later than Thursday, 6th July, 1922.
8519

SITUATIONS OPEN

WANTED, a TECHNICAL SALESMAN for South Africa, experienced in drawing up and suggesting applications for the use of Ball and Roller Bearings in all types of Machinery and Line Shafting. Address, stating age, qualifications, and salary required, 8613, The Engineer Office. 8613 A

WANTED, a Thoroughly Trained ENGINEER, well versed in the Design and Construction of Motor Lorries; must have had experience of maintaining a mixed fleet of vehicles, also the construction and running of large repair depots.—Write, Z. C. 895, c/o Deacon's, Leadenhall-street, London. 8602 A

WANTED, ADVERTISEMENT and PUBLICITY EXPERT, to Prepare Catalogues, Circulars, Advertisements, Announcements, &c. Steam, electric and mining experience desirable.—Applications, stating age, full experience, and salary required, must be made on sheets written on one side only, in envelopes marked in left-hand top corner "A.P.X.," addressed to ROBERT A. HOPKINSON, Chairman and Managing Director, Messrs. J. Hopkinson and Co., Ltd., Makers of Patent Safety Boiler Mountings and Valves, Britannia Works, Huddersfield. 8590 A

WANTED, an Experienced ROPEWAY ENGINEER, capable of laying out plants on all systems and with full experience of design and detail of all parts.—Address applications, giving experience and salary, 8610, The Engineer Office. 8610 A

A FIRM of Constructional Engineers REQUIRE the SERVICES of a First-class DESIGNER with workshop experience, capable of taking full charge of designing and estimating departments. Please state age, salary required, and give details of previous experience. None but those having held similar positions need apply.
Address, P5640, The Engineer Office. P5640 A

ASSISTANT ENGINEER REQUIRED for Public Works in Chile.—Write, stating age, married or single, experience, and salary required, to Box B. 25, Willing's, 119, Moorgate, E.C.2. 8593 A

AUTOMOBILE ENGINEER, Fully Qualified, WANTED for service in West Africa; must be experienced in all repair work and maintenance American lorries.—Box C148, Lee and Nightingale, Advts. Offices, Liverpool. P5628 A

ENGINEER, Experienced in Marine Construction Work, REQUIRED by Firm of Civil Engineers and Contractors for Supervision of Works. Experience of Reinforced Concrete Construction desirable.—Address applications, stating previous experience, salary required, and reference, 8594, The Engineer Office. 8594 A

ENGINEER REQUIRED for MUNICIPAL WATER-WORKS in China. Candidates should have good technical training and previous waterworks experience, some knowledge of alternating current desirable, age about 30.—Applications, stating physical fitness, &c., together with qualifications and testimonials, by letter only, to "H. K.," c/o J. W. Vickers and Co., Ltd., 9, Nicholas-lane, E.C.4. 8596 A

FIRST-CLASS MANAGER WANTED IMMEDIATELY for large new wet process rotary kiln cement plant in India nearing completion. First-class salary will be paid to the right man, preferably one having had varied cement works experience.—MAXTED and KNOTT, Ltd., Consulting and Cement Works Engineers, Burnett-avenue, High-street, Hull. 8635 A

HEATING AND VENTILATING.—REQUIRED, really capable DRAUGHTSMAN for London Engineer's Office. Must be fully experienced in the design and supervision of contracts and also capable estimator.—Address, stating age, qualifications, salary required, &c., P5637, The Engineer Office, P5637 A

REPRESENTATIVE REQUIRED for Newcastle and the North of England by established Firm of Reinforced Concrete Engineers, on commission and expenses basis. Knowledge of Civil Engineering and live connection amongst architects, engineers and contractors essential. Agents now conducting one or two good-class building trade agencies preferred. State fullest particulars.—Address, P5662, The Engineer Office. P5662 A

REQUIRED by Old-established Engineering Firm in India, SALESMAN for their Hardware and General Engineers' Stores Department, aged about 25 and single.—Reply, giving full details of experience, stating age and salary required, Z. R. 886, c/o Deacon's, Leadenhall-street, London. 8604 A

REQUIRED by Old-established Engineering Firm in India, OIL MILL MACHINERY SALESMAN, who must have expert and up-to-date knowledge both in theory and the practical running of such machinery.—Reply fully, stating experience, age, whether married or single, and salary required, Z. P. 885, c/o Deacon's, Leadenhall-street, London. 8603 A

WORKS MANAGER REQUIRED by Large Midland Firm of Structural Engineers and Colliery Screening Plant Manufacturers. A first-class energetic man required, ex-Service preferred.—Address, 8587, The Engineer Office 8587 A

SITUATIONS OPEN (continued)

THE SERVICES of a Competent GENTLEMAN are REQUIRED for the POST of CHIEF ENGINEER at a large Iron and Steel Works near the East Coast. In making the selection preference will be given to men who have had thoroughly practical experience in the economic running of sheet bar mills. Applicants should also have had experience in modern coke oven, blast-furnace and steel furnace design and maintenance, as well as all auxiliary plant pertaining thereto.

Only thoroughly live men need apply. Suitable house available.

Applications, giving age, experience, and salary required, together with recent references,
Address, 8557, The Engineer Office. 8557 A

WORKS MANAGER.—WANTED for Six-mill Tin-plate Plant in India, a TECHNICAL WORKS MANAGER. A man with sound practical training and wide experience, age preferably not over 42, capable of supervising European staff and native labour, is required. Applicants should state age and experience, with full details of training and positions held and submit references. Engagement will be for four years with renewal by mutual arrangement.—Apply, Box "B," SHAW and BLAKE, Ltd., 37, Surrey-street, Strand, W.C. 2. 8585 A

WANTED AT ONCE, First-class DRAUGHTSMAN, thoroughly experienced in the Design of all sizes of Electric Cranes. Preference given to one who has had considerable practice in estimating. State age, experience, and salary required.—Address, 8538, The Engineer Office. 8538 A

WANTED, CHIEF DRAUGHTSMAN by Firm of General Engineers in the Midlands, accustomed to control of office routine and experienced in Hydraulic and General Engineering.—Address, stating age, experience, and salary required, 8539, The Engineer Office. 8539 A

WANTED, DESIGNING DRAUGHTSMAN, Capable of developing new line of Centrifugal Pumps. Must be technically trained and capable of assuming full charge of work. Location, Lancashire. State age, education, practical experience, and salary expected.—Address, 8529, The Engineer Office. 8529 A

WANTED, DRAUGHTSMAN, Experienced in Design of Main Line and Light Railway Wagons of various types, estimating weights, and taking out bills of quantities.—Address, giving full particulars of experience, salary required, and age, 8634, The Engineer Office. 8634 A

DRAUGHTSMAN REQUIRED for the Bombay Office of a British Firm of Constructional Engineers. Must have wide experience in the Design of Constructional Steel Work, including Steel-frame Buildings, Bridges, &c., with good technical training and works experience. Age 28/30. Preferably single. Salary Rs. 750 per month. Free passage out and home under agreement for three years' minimum.—Address, 8633, The Engineer Office, stating age and detailed experience. 8633 A

DRAUGHTSMAN REQUIRED Temporarily, London, experienced in High-speed Engines. State age, salary, and experience.—Write, "Z," c/o Street's, 30, Cornhill, E.C. 3. 8600 A

DRAUGHTSMAN REQUIRED, Motor Bodies, London. Sound previous exp. body building essential; £260 p.a.—Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-street, E.C. 2. No preliminary fee. 8545 A

DRAUGHTSMAN.—WANTED on N.E. Coast, in large Constructional Works, first-class DRAUGHTSMAN with latest modern blast-furnace experience. No application except from men with this experience will be considered. Good wages to right man.—Address, 8512, The Engineer Office. 8512 A

DRAUGHTSMAN, with Thorough Knowledge of Light Electrical Truck and Hoist Design, REQUIRED by works near London. A man with practical knowledge of light internal combustion engines would be preferred, but sound electrical knowledge combined with thorough constructional ability, experience in modern machine shop practice and economical production is essential.—Address, stating experience, salary required, copies of testimonials, &c., 8641, The Engineer Office. 8641 A

FOUNDRY FOREMAN for London Ironfoundry. Must be a good practical moulder and used to control of men.—Address, stating age, experience, and salary required, P5650, The Engineer Office. P5650 A

SITUATIONS WANTED

ADVERTISER, Experienced in Buying and Stores management, DESIRES NEW APPOINTMENT, London district.—Address, P5652, The Engineer Office. P5652 B

AS WORKS MANAGER, Thoroughly Practical, well educated ENGINEER, with sound experience in loco., steam, general engineering, millwrighting, ironfoundry and repair work. Past 23 years successful control of labour as foreman and works manager.—Address, P5609, The Engineer Office. P5609 B

ASSISTANT TO MANAGING DIRECTOR, ENGINEER OR SECRETARY.—A.M.I.C.E., aged 40, SEEKS POST; late Squadron Leader, R.A.F., had charge of drawing-office, works and office staffs. Knowledge of bookkeeping, cost accounts, secretarial duties, company law; willing to work one month without salary to prove ability if prospects good.—H. A. C., Smith's Library, Broadway, Ealing. P5649 B

BUYER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 618, c/o Deacon's, Leadenhall-st., E.C. 8544 B

ENGINEER, G.I. Mech. E. (25); 2 Years Tech. (Finsbury), 4 years shops, 3 years D.O., adaptable, SEEKS SITUATION.—23, Ashdown-road, Kingston-on-Thames. P5635 B

ENGINEER, Late Manager Small London Works, good experience of general engineering, 16 years in responsible positions, SEEKS ANY POST, anywhere. Moderate salary.—SNOAD, 36, York-road, Hitchin. P5641 B

ENGINEER (36), Late Manager Small Works, Charge D.O. 7 years, general engineering, steam, petrol, plant, railway tracks, SEEKS any POST anywhere. Moderate salary.—Address, P5605, The Engineer Office. P5605 B

SITUATIONS WANTED (continued)

ENGINEER SEEKS POSITION of Permanent character in good firm of consulting marine engineers. Holds B. of T. chief engineer's certificate; has had experience in Diesel work, supervision of repairs to machinery, boilers and ships, and since October, 1919, has represented a firm of consulting marine engineers on the Continent. Willing to invest capital.
Address, P5587, The Engineer Office. P5587 B

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For continuation of Small Advertisements see page iii

Electrification of the Chilean State Railways.

As a means of greatly reducing the working expenses, increasing the traffic capacity, and eliminating the present dependence upon coal supply from foreign countries, the administration of the Chilean Government Railways has decided upon a policy of electrification of the broad-gauge main lines, utilising the great natural water-power resources of the country for the generation of current.

The railways of Chile, like those of other South American States, are largely dependent upon foreign fuel supplies for their locomotives, and they were awakened sharply to the dangers of such a condition by the severe shortage of coal which resulted from the interruption of ocean traffic by the world war. In Brazil there have been introduced both electric traction and the utilisation of domestic low-grade coal by the pulverised fuel system. In Chile, a general policy of electrification has been adopted. It is not to be understood that there is no native coal, but with an annual consumption of 2,700,000 tons there is a production of only 1,800,000 tons. About 550,000 tons are required by the railways.

The necessary increase in locomotive equipment—both in size and number—to handle the increasing traffic would still further increase the dependency and the great cost for fuel as an item in the working expenses. Prior to the war the price per ton for imported coal ranged from £1 10s. to £2, including transportation and lighterage charges. During the war the price is said to have been from £5 to £6 per ton, but recent prices range from £3 to £4. On the other hand, there are wide possibilities for the production of hydro-electric power, and a large amount of such power is now available at reasonable prices. An added advantage will be the elimination of the non-paying coal traffic in distributing railway fuel and the consequent release of a large amount of rolling stock for general goods traffic.

Following the trying war period, especially in 1917, when coal imports almost ceased and the price of the restricted supply increased enormously, the problem of applying electric traction to the main lines was submitted in 1918 to a commission which studied not only the conditions and requirements of the Chilean railway system, but also the development of and experience with railway electrification in other countries. On the basis of the economic advantages shown by this report, the Government decided to electrify the broad-gauge system and to divide this system into zones for consecutive treatment.

It was decided also to undertake at once the equipment of the first zone, which includes the main line between Valparaiso and Santiago—116 miles—and the Las Vegas branch—28 miles. For this work, which represents about one-tenth of the broad-gauge lines of the State Railways, a loan of £2,100,000 was authorised, and was very quickly subscribed. In 1921 a contract for the electrification of this first zone was placed in the United States, being awarded to the Westinghouse Electric and Manufacturing Company, in conjunction with the Chilean firm of Errazuriz, Simpson and Co. This contract covers the line equipment for 144 miles, thirty-nine locomotives, and three sub-stations at a cost of about £1,400,000. Current will be obtained from existing hydro-electric plants.

Two main results are expected to be accomplished by this change on a line which has severe working conditions. First, an increase of capacity on the existing trackage by permitting heavier trains, faster runs and a more frequent service; secondly, a material reduction in working expenses by reducing the expenses for fuel, engine and train crews, coaling and water stations, maintenance of locomotives and maintenance of permanent way.

The railway system of Chile aggregates about 5200 miles in a country having a north and south length of 2600 miles and a width of 100 to 250 miles, with an area of some 300,000 square miles and a population of 4,000,000. Approximately one-third of the total mileage is owned by various private companies, and consists largely of lines worked mainly for mining and industrial concerns. The greater part of the railways, however, are owned by the State, and comprise two general systems:—(1) The broad-gauge lines—5ft. 6in.—which extend south from Valparaiso to Santiago and Port Montt, including numerous branches; (2) the narrow-gauge lines, which are mainly in the north, but include some branch lines in the southern portion. Although the climatic conditions have an extreme range in a country of such great length from north to south and including a great mountain range, only a moderate range occurs in the district traversed by the railways which are to be electrified. Thus the maximum summer temperature is 100 deg. to 110 deg. Fah. in the shade or 130 deg. to 140 deg. in the sun, while the minimum winter temperature is about 20 deg. to 25 deg. The rainfall is relatively small, but inexhaustible water power is available from streams fed by the heavy snows in the Andes.

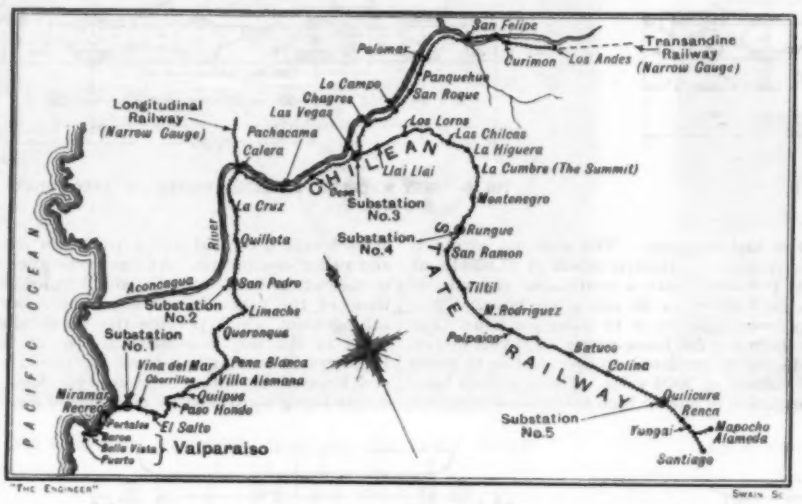

FIG. 1—SKETCH MAP SHOWING CHILEAN RAILWAYS TO BE ELECTRIFIED

On the lines included in the first zone for electrification it was necessary, at the time of the coal shortage in 1917, to work an excessive number of relatively light trains. This resulted in a congestion of traffic that nearly approached the working capacity of the lines. This condition was relieved later, however, by the introduction of more powerful goods engines of the 4–8–2 type. With electric traction the present capacity of the lines will be nearly trebled.

To increase the capacity if steam locomotives were continued would require engines so much heavier than those now in use that probably heavier rails would have to be laid at considerable expense, and the cost of maintenance of way would be increased. For electric working it is claimed that much greater tonnage may be handled on the present rails owing to the reduced stresses in track, while it will also enable the number of trains and the train tonnage to be increased. Furthermore, for a given tonnage handled the cost of train maintenance will be less with electric than with steam working.

The first stage of electrification comprises an entire working division—the 116-mile main line between the cities of Valparaiso and Santiago, and the 28-mile branch to Los Andes, which is the terminus of the narrow-gauge Transandine Railway of the Argentine Republic. These lines are shown in the map—Fig. 1. From the port of Valparaiso the line passes through the summer resort of Vina del Mar, and after crossing the low coast range it follows the fertile valley of the Aconagua River to Las Vegas. At Calera there is a junction with the Longitudinal Railway, running north to Antofagasta and Iquique. At Llai-Llai, about halfway between Valparaiso and Santiago, the mountain gradients begin, and this point is the meeting station for all main line passenger trains making connections with trains on the Los Andes branch beginning at Las Vegas. On the eastern side of the range the heavy gradients extend to Batuco.

The line is double for 36½ miles, as follows:—From Valparaiso to Limache, 27 miles; Ocoa and Llai-Llai, 8 miles; and Yungai and Mapocho, 1½ miles. Most of the main line is laid with 80 lb. flange rails, but 85 lb. rails are laid from Llai-Llai to La Cumbre and from Calera to Ocoa. The Los Andes branch has 75 lb. rails. Native oak sleepers in stone ballast are used on the greater part of the line.

The general arrangement of the gradients is shown by the longitudinal section in Fig. 2, the figures indicating the maximum gradients. The heaviest gradient is 2.25 per cent., or 1 in 44, for nearly 12 miles between Las Vegas and the summit at La Cumbre, which has an elevation of 2600ft. above sea level. On the eastern slope of the range the heaviest gradient is 1.81 per cent., or 1 in 55. Banking engines for goods trains are required at several points and for passenger trains on the Tabon gradient up to the La Cumbre summit. With electric working, bank engines will be required only for heavy goods trains on the Tabon gradient. The curvature is extensive and severe, and is largely concentrated on the heavy gradients. The sharpest curves are of about 530ft. radius.

Of six tunnels, three are on the Tabon incline, and the longest—at San Pedro—is 1600ft. in length. This tunnel is rather wet, but the others are dry, so that there will be no serious corrosion of the overhead wiring. There is sufficient headroom above the rails to make the design of the wiring and locomotive equipment an easy matter. An advantage to passengers and train crews will be the elimination of the present smoke nuisance in the tunnels. The Las Cucharas double-line 440ft. steel cantilever bridge over the Vina del Mar River near Valparaiso is the largest structure on the line, but there are numerous plate girder bridges.

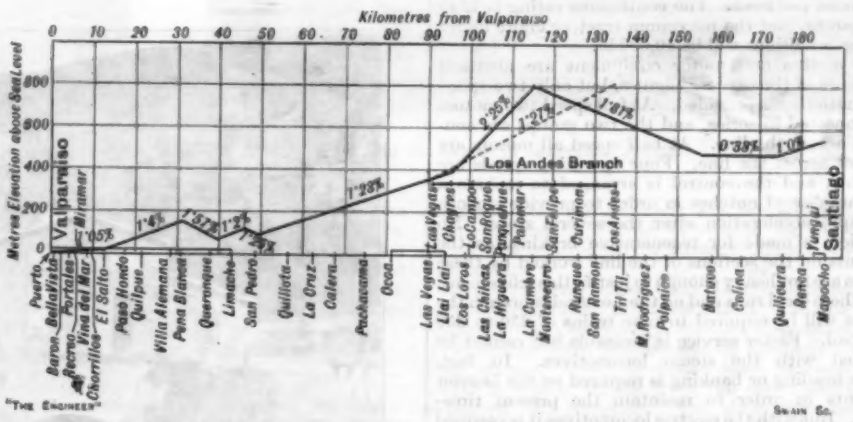

FIG. 2—PROFILES OF THE LINES BETWEEN VALPARAISO AND SANTIAGO, AND LAS VEGAS AND LOS ANDES

Electric Locomotives.

The present contract provides for thirty-nine engines, as follows:—Six 127-ton express passenger engines, 2–6–0–0–6–2; eleven 80-ton local passenger engines, 0–4–0–0–4–0; fifteen 113-ton goods engines, 0–6–0–0–6–0; and seven 65-ton shunting engines, each carried on two four-wheel bogies with all axles motor-driven.

Passenger Engines.—Express trains between Valparaiso and Santiago consist usually of six to ten carriages, making a load of 200 to 300 gross tons behind the tender. Sometimes there are fifteen or sixteen carriages, in which case bank engines are used on the Tabon incline. The electric express locomotives—Fig. 3—will be able to handle the heavy trains without the aid of bank engines. Their nominal rating is 2250 horse-power, corresponding to a tractive effort of 23,400 lb. at a speed of 37 miles per hour. The maximum speed capacity is 62½ miles per hour. With a total weight of 127 tons there will be 105 tons on the drivers. The wheel arrangement consists of two groups of three driving axles, with a two-wheeled bogie at the outer end of each group. The frames of the driving-wheel groups will be connected by a draw bar and fitted with spring buffers.

Six motors of 375 horse-power—of the field-control type and with forced ventilation—drive the axles through flexible spur gears. Three-speed combinations are provided. For the lower speeds all six motors will be connected in series, giving to 33 per cent. of maximum speed. For medium speeds, up to 66 per cent., three motors will be connected in series, and the two groups will be connected in parallel across the line. For full speed, three groups of two motors connected in series will operate at full line potential.

Regenerative braking is so arranged that regenera-

tion is available on all the speed combinations and at speeds of 15 to 50 miles per hour. The motors are of the field-control type, with fields excited by a low-voltage generator driven by a 3000-volt motor. This motor generator also supplies current for the ventilating blower, the air-compressor motors, and the lighting and control circuits. The Westinghouse air-brake equipment will be similar to that on the present steam locomotives, using straight air when handling the engine alone, and the automatic action for locomotive and train.

With the fastest steam trains the run between Valparaiso and Santiago is made in 3 hours 40 min., but it is intended to reduce this by 25 min.—or to 3 hours 15 min.—with the electric locomotives. These engines are also expected to maintain a speed of 33½ miles per hour on the Tabon incline.

Local trains working between Valparaiso and Llai-Llai often have ten carriages, but the gradients are such that a single engine can work the entire run. The eleven electric locomotives for working these trains are designed to take twelve carriages. Each engine—Fig. 4—has two groups of four driving wheels, with the bogie cross frames connected by a hinge as in steam locomotives of the Mallet type. These engines have a nominal rating of 1500 horse-power, corresponding to a tractive effort of 15,600 lb. at a speed of 37 miles per hour. Their maximum speed is 56 miles per hour. The continuous rating is 1240 horse-power, and the maximum tractive effort under starting conditions will be 40,000 lb.

The motors and motor equipment are identical with those of the express engines, but only two-speed combinations are provided. At full speed two motors are connected in series, and the two groups are connected across the line. At half speed all motors are in series across the line. Four operating speeds are available, and the control is arranged to include a large number of notches in order to provide smooth and rapid acceleration after the several stops. No provision is made for regenerative braking, as the gradients on the sections of the line worked by these engines are not heavy enough to justify this refinement.

On these local runs and on the Los Andes branch the engines will be required to take trains of 250 to 350 tons load. Faster service is desirable but cannot be obtained with the steam locomotives. In fact, double-heading or banking is required on the heavier gradients in order to maintain the present time-tables. But with the electric locomotives it is planned to shorten the time and thus improve the service.

Goods and Shunting Engines.—In goods service the southbound traffic is slightly the heavier, averaging 3600 tons daily from Valparaiso and 3900 tons through the junction at Las Vegas. The southbound goods trains have from twenty to thirty wagons, or 550 tons behind the tender, are worked by 4–8–2 steam locomotives assisted by banking engines of the 2–8–0 type between El Salto and Pena Blanca and on the Tabon incline. Northbound trains take a banking engine for the 6 miles from Til Til to Rungue. On these two banks the speed is only 10 to 14 miles per hour.

With the electric locomotives—shown in Fig. 5—the load will be increased 40 per cent.—to 770 tons—and the same amount of traffic will be handled with a reduction of 25 per cent. in the number of trains. One engine will handle this 770-ton load over the entire line, except for the ascent of the 12-mile Tabon incline of 1 in 44, where a banking engine will be employed. The speeds will be about 35 miles per hour on approximately level line, and 24 miles per hour on the incline. With the higher running speed and the elimination of stops for taking coal and water it is expected to make the run in four or five hours less than with the steam locomotives handling 550-ton trains.

Each goods engine will have two driving bogies with three axles each, the bogies being connected by a hinge, and all buffing stresses being transmitted through the underframing. The nominal rating is 1680 horse-power, or a tractive effort of 27,950 lb. at 22.6 miles per hour, with a continuous capacity of 20,880 lb. at a speed of 25 miles per hour. Their maximum speed capacity is 40 miles per hour. For each axle there is a 280 horse-power 1500-volt motor, the motors being insulated to operate two in series for a line voltage of 3000 volts. These motors have forced ventilation to ensure high continuous capacity. They drive the axles through flexible gears as in the passenger locomotives, the gear ratio in this case being 3.94 to 1. The speed combinations are the same for driving and for regenerative braking, the motor fields being separately excited in the latter case by a 3000-volt motor generator set. This set also provides low-voltage power for the air compressors, ventilating blowers, control equipment and lighting.

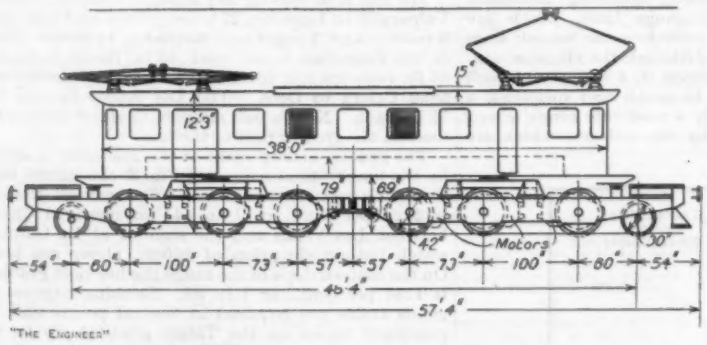

FIG. 3—EXPRESS ELECTRIC PASSENGER LOCOMOTIVE

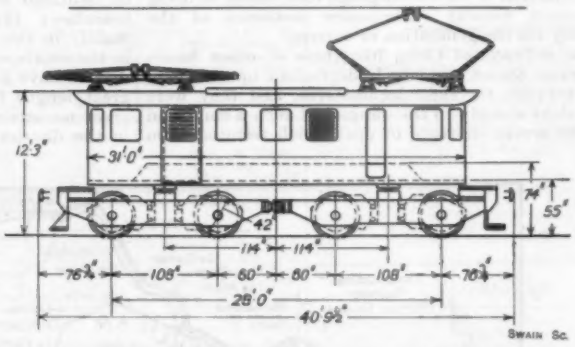

FIG. 4—EIGHT-WHEELED ELECTRIC PASSENGER LOCOMOTIVE

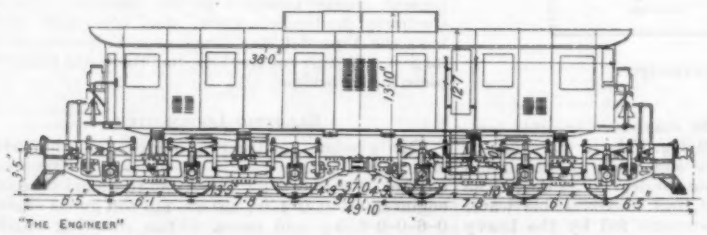

FIG. 5—TWELVE-WHEELED ELECTRIC GOODS LOCOMOTIVE

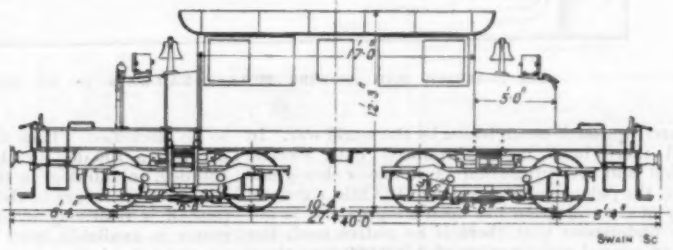

FIG. 6—ELECTRIC SHUNTING LOCOMOTIVE

Cast steel frames of the bar type are used for the bogies and are placed outside of the wheels. Semi-elliptic plate springs are placed over the driving boxes and are connected by equaliser beams carried in the frames. The outer spring hangers are attached to coil springs seated in the frames. The Westinghouse air brake is used, in accordance with the standard practice of the Chilean State Railways. It is so interlocked with the regenerative braking system that the latter may be supplemented by applying the air brake throughout the train without applying it to the engine driving wheels. Automatic couplings of the American type are provided, but as they are not yet in general use in Chile the European type of chain coupling is also provided.

The cab, 38ft. long, has a driver's compartment at each end, a central compartment for the electrical and other equipment. At one bogie the centre pin is restrained both laterally and longitudinally, but that of the other is restrained only laterally, an arrangement which permits free longitudinal movement of the cab in relation to one of the bogies. Pantagraph current collectors are raised by springs and lowered by compressed air cylinders, all movements being controlled by compressed air. They are automatically locked when in the lowered position. Individual switches arranged in banks establish the main circuit connections and are operated by compressed air under the control of electro-magnetic valves. In each driver's compartment is a master controller to provide for double-end operation, this controller serving both for driving and for regenerative braking.

Goods yard and shunting service will be performed by engines of the double-bogie type with four motors of 120 horse-power driving the axles through solid helical gears. They have a nominal rating of 560 horse-power, corresponding to a tractive effort of 19,500 lb. at 11 miles per hour. The continuous capacity is 11,500 lb. at 12.5 miles per hour, and the maximum tractive effort under starting conditions

FIG. 7—THE FLORIDA HYDRO-ELECTRIC GENERATING STATION

is 34,000 lb. Their maximum speed is 35 miles per hour. These engines—shown in Fig. 6—are designed to handle train loads of 1200 tons in the yards.

The bogies have outside frames resting on the boxes and carrying the transverse bolsters with the centre pins. The four motors are of the series type with two-speed control. For full speed two groups of two motors each will be connected across the line, and for half speed all the motors will be connected in series. In general, the motor, brake, coupling, and

there will be steel penstocks laid down the mountain-side to the station, giving a head of 580ft. The station equipment will consist of three Westinghouse 8125 kVA generators, and its ultimate capacity will be 30,000 kilowatts.

From the power station a twin-circuit transmission line of 110,000 volts, carried on steel towers, will extend to a receiving station at Santiago. This station is also connected with the present supply of that city, which includes the Florida hydro-electric

at Vina del Mar, San Pedro, Llai-Llai, Rangue and Qui'Icura. Each will be equipped with two 2000-kilowatt motor generator sets, and will have space for a third set. Each set consists of a 2800 horse-power 50-cycle three-phase 2300-volt motor driving two 1000-kilowatt 1500-volt generators connected in series. Two direct-current exciters will be provided for exciting the motor and generator fields respectively. These sets can carry a 20 per cent. overload for five minutes without injury, but as an additional

FIG. 8—16-COACH PASSENGER TRAIN ON THE TABON INCLINE

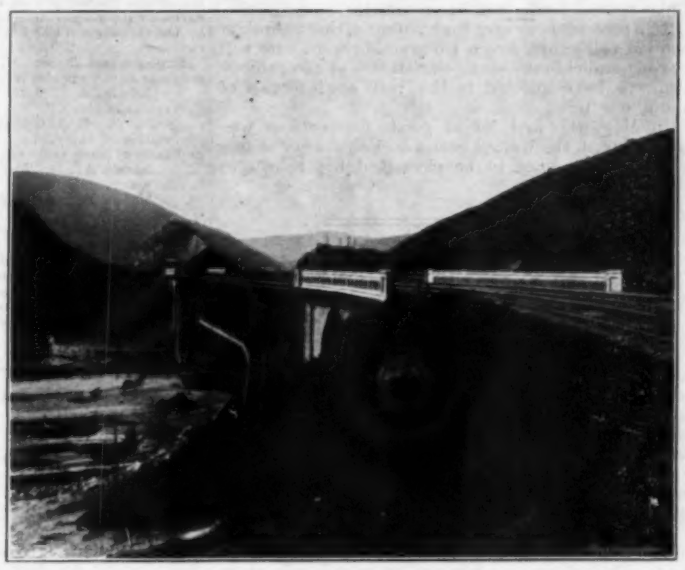

FIG. 9—LAS CUCHARAS BRIDGE OVER THE RIVER VINA DEL MAR

FIG. 10—EAST PORTALS OF THE TWO PASO HONDO TUNNELS

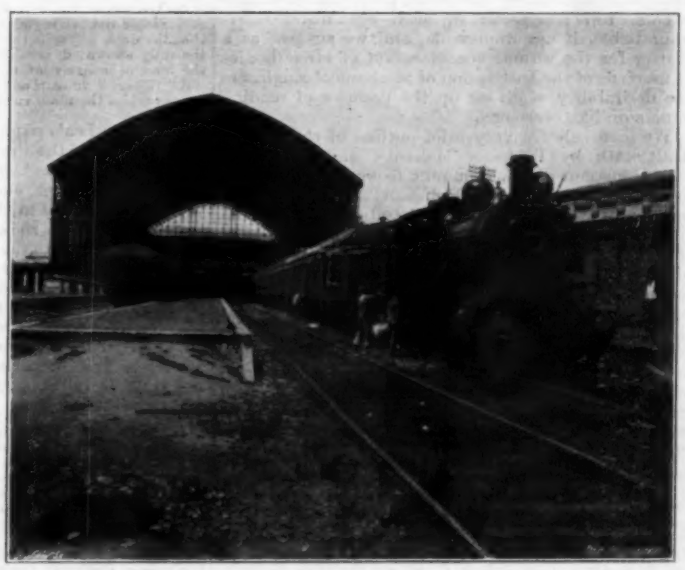

FIG. 11—TRAIN IN MAPOCHO STATION

electrical equipments are similar to those of the goods locomotives. The general dimensions of the four types of locomotives are given in the accompanying table.

HYDRO-ELECTRIC STATIONS.

The railway administration will not establish its own generating stations, but will purchase power from private plants. One of these stations is now being built about 37 miles from Santiago by the Chilean Electric Tramway and Light Company. This is known as the Maitines station, and takes water from the Rio Colorado by a 5-mile canal which includes tunnels. From the forebay at the end of the canal

plant of 15,000 kilowatts, and the Mapocho steam plant, with an ultimate capacity of 20,000 kilowatts. The 110,000-volt transmission line will be extended to Valparaiso, but for reasons of economy the end sub-stations of the electrified lines will be fed from 12,000-volt transmission lines extending from step-down transformer stations near Santiago and Valparaiso. A transformer station near Til Til will step the 110,000-volt current down to 44,000 volts, and a 44,000-volt transmission line will extend thence to Limach to feed the railway sub-stations and to supply power to local industries.

Electric Locomotives for the Chilean State Railways.

Service.	Express passenger.	Local passenger.	Goods.	Shunting.
Wheel classification	2-6-0-0-6-2	0-4-0-0-4-0	0-6-0-0-6-0	0-4-0-0-4-0
Length over buffers	57ft. 4in.	40ft. 6in.	49ft. 10in.	40ft. 0in.
Total wheel base	48ft. 4in.	28ft. 0in.	37ft. 0in.	27ft. 4in.
Rigid wheel base	14ft. 5in.	9ft. 0in.	13ft. 9in.	8ft. 6in.
Length of cab	38ft. 0in.	31ft. 0in.	39ft. 0in.	17ft. 0in.
Driving wheels	3ft. 6in.	3ft. 6in.	3ft. 6in.	3ft. 6in.
Bogie wheels	2ft. 6in.	—	—	—
Weight complete	253,600 lb.	160,000 lb.	226,000 lb.	136,000 lb.
Weight of mechanical parts	160,000 lb.	96,000 lb.	140,000 lb.	86,000 lb.
Weight of electric equipment	93,600 lb.	64,000 lb.	86,000 lb.	50,000 lb.
Weight per driving axle	35,000 lb.	40,000 lb.	37,670 lb.	34,000 lb.
Weight per bogie axle	21,800 lb.	—	—	—
Total height over cab	12ft. 3in.	12ft. 3in.	13ft. 10in.	12ft. 3in.
Width over cab	10ft. 0in.	10ft. 0in.	10ft. 0in.	10ft. 0in.
Height of coupling	3ft. 5in.	3ft. 5in.	3ft. 5in.	3ft. 5in.

Sub-stations.—Five sub-stations will be provided—

safeguard they will be fitted with the Westinghouse flash suppressor. Forced ventilation for the generators will be supplied by blowers under control of thermostats.

At the two end sub-stations the transformers will have a voltage ratio of 12,000 : 2300. The one near Valparaiso will receive 12,000-volt three-phase 50-cycle current from the generating company's step-down station. The sub-station near Santiago will receive a similar supply from the other step-down station of the company. The three intermediate sub-stations will receive power at 44,000 volts, and the transformer ratio will be 44,000 : 2300. All transformers will be of the oil-insulated self-cooled type. Yard feeder switches will be provided at each sub-station to connect up the two sections of line and thus cut out the sub-station in case of trouble within the station.

OVERHEAD EQUIPMENT.

The overhead wire or trolley-wire system of operation was adopted, with 3000-volt direct current on the trolley wire. This equipment will be of the simple catenary type with a ⅜in. steel cable carrying flexible hangers from which the 4/0 trolley wire is suspended. Posts spaced at intervals of 197ft. will carry the wire at the unusual height of 19½ft. above the rails. At tunnels, however, this headroom will be reduced.

Bracket arms will carry the cable on tangents and easy curves. Cross span-wire construction will be used on sharp curves, in yards, and where there are more than two lines of rails. The feeders and power-indicating and limiting wires will be carried on wooden

cross arms, while the ground return wire will be carried near the top of the post. Rail joints will be bonded with welded bonds, but in the goods yards only one rail of each line will be bonded.

Two 500,000 c.mil. feeders will extend from Valparaiso to sub-station No. 2 at San Pedro, whence one feeder of the same capacity will extend to Ocoa. Beyond this there will be two 250,000 c.mil. feeders to sub-station No. 3 at Llai-Llai, and one 50,000 c.mil. feeder to Yungai, near Santiago. From this point to the Mapocho generating station there will be two 250,000 c mil. feeders. On the Los Andes line a single 700.000 c.mil. feeder will be provided.

As a protection against high potential due to broken bond at rail joints, &c., a 4/0 ground return wire will be run parallel to the single-line stretch of the railway and will be connected to the rails at intervals of about one mile.

In May, the first lot of goods locomotives was shipped from the United States to Valparaiso. Some views on the lines to be electrified are shown in Figs. 7 to 11.

Institution of Mechanical Engineers.

SUMMER MEETING.

No. II.*

LAST week we closed our account of the summer excursion of the Institution at the middle of the meeting on Thursday, June 15th. Two papers had been taken on that day, one by Professor Rateau and one by Mr. Reavell, and, owing to the smallness of the audience, it had been decided to find opportunity for a full discussion of them sometime in the autumn. Two other papers remained to be dealt with. The first was by Professor A. L. Mellanby and William Kerr, and the second by Professor F. C. Lea. The attendance had not increased, and there were not more than some score of people in the room at the time. Apart from the fact that such a small attendance must be very disappointing to authors who have spent much time in the preparation of their papers, full discussion in such circumstances is improbable, if not impossible, and we suggest as a matter for the serious consideration of other bodies as much as of the Institution of Mechanical Engineers the desirability of giving up the practice of reading papers on like occasions.

We give below a very brief outline of the subject dealt with by Professor Mellanby and Mr. Kerr. The discussion did not amount to very much. The principal speaker was Professor Rateau, whose remarks it will be advisable to study in the translation that will appear in the "Proceedings." The theory of supersaturation was apparently new to most of the audience, and there was plainly some disinclination to accept it on reasoning which is almost wholly deductive. Mr. Pendred probably expressed the general feeling when he said that whilst engineers could readily understand that steam could be superheated, they could not understand how steam could pass below condensation temperature and pressure without condensing. Dr. Mellanby, in his reply, suggested that the steam had no time to condense in its extremely rapid passage through a nozzle.

SUPERSATURATED STEAM.

General.—In many quite simple nozzle experiments investigators have obtained flow quantities in excess of those calculated on the assumption of isentropic expansion of saturated steam. This apparent anomaly has recurred so frequently that the fact may be held as well established. On all considerations, of course, the flow ought to be less than the theoretical, since any type of loss or imperfection in the expansion must reduce the discharge blow the ideal value. Consequently, a result of this kind casts doubt on the soundness of the underlying theory. It is to be understood that the occurrence refers only to the flow of wet steam or of steam which—according to the ordinary conception of vapours—would become wet during expansion; and it must be admitted that the flow quantities are in such cases so close to the theoretical values that when allowances are made for the inevitable losses there is definite disagreement. Moreover, it is practically impossible to observe the temperature differences as the supersaturated fluid presumably creates a film of moisture on all material surfaces in contact with it. It is this point which makes the direct experimental examination of the matter so difficult.

The explanation of this excessive discharge has been frequently given and very completely investigated in a theoretical sense—notably by Mr. H. M. Martin and by Professor Callendar. It rests on the assumption that rapidly expanding steam may be in a state of supersaturation; that is, the ordinary function of condensation is, for the time being, suspended, and the fluid simply operates as a cold gas.

On the whole, the evidence in favour of the theory is convincing as regards excessive discharge in nozzles, and circumstantial as regards turbine operations in general; but it has appeared to the authors that this important experimental evidence on flow quantities is extremely scanty, and rests on a few isolated cases only. Although experiments of this kind are tedious, it would seem desirable to have the flow curves for steam in the region of the initially dry state clearly set up, so that the nature and extent of this evidence may be well understood. At present the subject suffers from over-development in a theoretical sense, and the almost complete lack of well-defined data renders even a narrow range of experimental results of value. The purpose of the present short paper is merely to give flow curves for a few simple convergent type nozzles in order to demonstrate this discharge effect with clearness, and to show the degree of support afforded the application of the theoretical conception to nozzles, by some actual experimental results.

Effect of Supersaturation on Flow.—Rapidly expanding steam is held to be in a thermally unstable condition on account of the high speed of flow, and its inability to condense within the time limits available. Condensation requires nuclei and a certain margin of time. In the absence or inadequacy of the former, or the insufficiency of the latter, the steam fails to act as a vapour and expands as a gas. Consequently, the relations governing the expansion of superheated steam will be applicable to this condition of supersaturated—or undercooled—steam. Under these circumstances, the temperature will be well below the saturation temperature; the heat made available in the expansion is rather less than for normal expansion in thermal equilibrium; the volume of the undercooled steam is distinctly less; and it is easy to show that the flow so determined is in excess of that by the ordinary theory to the extent of about 5 per cent. When time is given after expansion, or when the limiting state for supersaturated steam is reached, the fluid reverts to the normal wet condition with increase of entropy. Such is the simple aspect of this matter in so far as it concerns the nozzle discharge; and it very aptly explains the case of excessive discharge, since the flow through a nozzle is controlled by the throat condition and expansion to this point is extremely rapid.

Experimental Results.—The results which it is proposed to consider here comprise recent tests on:—

Nozzle A_1: 0.2507in. diameter, $\frac{1}{4}$in. length, $^7/_{32}$in. radius of entry.

Nozzle B_1: 0.2513in. diameter, $\frac{1}{4}$in. length, $^7/_{32}$in. radius of entry.

and tests of some years ago on—

Nozzle A_2: 0.251in. diameter, $\frac{1}{4}$in. length, $\frac{1}{4}$in. radius of entry.

Nozzle B_2: 0.250in. diameter, $\frac{1}{4}$in. length, $\frac{1}{4}$in. radius of entry.

All four nozzles are of the simple convergent or convergent parallel type, but A_1 and B_1 were used in conjunction with a search tube, so that the tests thereon include pressure measurements as well as flow determinations. Only flow tests were carried out on A_2 and B_2, as these were not fitted with a search tube. In all cases flow determinations were made with varying initial superheats at a supply pressure of about 75 lb. per square inch absolute.

The flow curves obtained from these four nozzles show certain variations between themselves, but they all agree on the two points:—

(1) That the flow, at and near the initially dry state, is excessive when compared with the theoretical, as obtained on the assumption of stable expansion.

(2) That the form of the flow curve over a small range of superheat beyond the initially dry condition, is not in agreement with the theoretical assumption of complete supersaturation on any rational basis of expansion losses.

The former elucidates the nature and magnitude of the much-discussed "excessive discharge," and demonstrates that the ordinary assumption of "wet" expansion is not a suitable theoretical basis. It is also seen that the flow may still be anomalous on this basis, although it may not be in excess, since the expansion losses control the actual margins.

The latter point indicates very conclusively that there is a departure from the condition of complete supersaturation during expansion. The difference is not perhaps great, but it is always shown.

On the whole, the investigation deals with small effects, and may create doubts because of that; but it must be admitted that the data, so far as they go, indicate partial reversion (from the fully saturated condition) during the rapid expansion at the inlet of convergent nozzles, and at conditions well within the "Wilson" limit; and do so by means of the evidence that provides the main substantiation of the general hypothesis.

Professor Lea's paper on "The Effect of Temperature on some of the Properties of Metals," from which we give a few points below, was discussed by Professors Rateau and Guillet, and again we would advise those who are interested in the subject to study the official translations when they appear. The paper describes briefly experiments that have been carried out during the last nine years. It is now very widely recognised that most metals lose strength after certain temperatures have been reached, but many engineers may be glad to have specific examples to which to refer. Attention in particular may be directed to Professor Lea's experiments with that very pure iron known as "Armco." His conclusion runs as follows:

The results of the tests described in this paper, together with other published and unpublished work, show clearly that below 250 deg. Cent. the effect of temperature, particularly on steels, does not give cause for anxiety in their use in cases where the above limit is not exceeded. They show, further, that many of the alloys of copper, also those of aluminium, are considerably affected by temperatures of 250 deg. Cent., and it is unwise to assume, because an alloy is as strong as steel or iron at ordinary temperatures, that it will remain so at higher temperatures. Temperatures above 350 deg. Cent., which may be reached in the case of aeroplane engine springs, may have a very marked effect on the elastic properties of steels. The limits of proportionality may become quite small, there are possibilities of hysteresis loops at comparatively small ranges of stress, and the moduli of rigidity and elasticity may be considerably less than at ordinary temperatures.

EXCURSIONS AND VISITS.

The afternoons of both Wednesday and Thursday were devoted to visits to engineering works in the neighbourhood of Paris, where the members were very hospitably received by their French hosts. On the former day the principal visits, as already noted, were those to the works of Hotchkiss and Co. and the French Thomson-Houston Company, Limited, to those of Messrs. Renault and to the Conservatoire National des Arts et Métiers, whilst on the second day large parties went to the works of Babcock and Wilcox and of the Société Générale de Construction Mécaniques and to the Société des Transports en Commun, the works of Messrs. Citroën and the wireless station at the Eiffel Tower.

At the Babcock works the visitors were fortunate enough to see in operation the little-known process of forming the sinuous steel headers which are a characteristic feature of the Babcock and Wilcox boiler. A few words about this very ingenious operation may be acceptable. It is performed in an hydraulic press provided with dies of the required form, and the feature of interest is the mandrel placed inside the square steel tube before pressing takes place. It is hardly necessary to point out that the mandrel could neither be inserted nor withdrawn were it sinuous and solid. It is therefore built up before and broken down after each operation.

Extending backward from the press is a trough, along the centre of which lies a built-up member. On each side of this central member are placed dies—formed actually of two pieces—which lie in two parallel rows. Seen from the side these dies would appear somewhat as follows:—⊐⊏⊐⊏⊐⊏. The square steel tube heated red hot is placed under the press, and immediately the string of dies is thrust forward out of the trough till it lies inside the tube. The pressure is then put on, and every alternate pair of ⊐s is pressed upwards or downwards, as the case may be, the round back of the ⊐ forming the corresponding corrugation. The central member is then withdrawn, with the result that all the ⊐s are released and fall freely in the tube from which they are immediately hooked out by men provided with long steel rods.

On Thursday evening the Institution dinner was held at the Hotel Continental. The principal speech of the evening was made by Professor Guillet, and was translated into English by Mr. Le Gros, whose performance of the difficult task of translation on that and many other occasions calls for the highest praise.

Friday was given up wholly to visits. A large proportion of the members travelled by motor char-à-bancs to Fontainebleau, whilst others went to the great power station of the Union d'Electricité, and others to Paris waterworks. A delightful *soirée*, provided by the Association Amicale des Anciens Elèves de l'Ecole Centrales des Arts et Manufactures, brought the Paris meeting to a happy end.

On Saturday morning a large wreath of flowers was placed by the President, who was supported by many members and ladies, upon the tomb of the Soldier of France beneath the Arc de Triomphe.

On the same afternoon about half the party left for Liége, and on the following morning a visit was paid to Loncin fort, the last of the twelve forts around Liége to succumb to the German attack. It was destroyed by the explosion of its magazine, and thereby three hundred men met their death in the ruins. There they still lie in the most pathetic monument of the war on land. At the same time the President, secretary, and some representatives from the Council attended the unveiling of the war memorial in the house of the Liége Association of Engineers.

On Sunday afternoon the opening ceremony of the little exhibition which has been organised by the Liége Association of Engineers, or, to give it its full title, the Association des Ingénieurs sortis de l'Ecole de Liége, was attended. In that ceremony, M. Gustave Trasenster, President of the Association, presented an address to the King of the Belgians, who then replied in a short speech, and having declared the Exhibition open, made a tour of the buildings. The exhibition is being held in the Parc de la Boverie, on the eastern bank of the Meuse, and the principal building is the Palais des Beaux-Arts, which was erected for the exhibition of 1905. Two other buildings, one at each end of the Palais, have been constructed for the present display. Some two hundred and fifty firms and societies are represented, and whilst the exhibition is, of course, not a big one, it has many interesting features. An excellent *Compte Rendu* of it, in which brief descriptions of all the stands are given, has been issued. Any engineers who are in Belgium during the next few weeks may be counselled to pay it a visit. It closes on July 31st.

On Sunday evening a banquet of 950 covers, arranged by the Liége Association of Engineers, was attended by many of the British members, and on Monday and Tuesday, members were invited to take part in the meetings and visits to local works, which formed part of the programme which had been prepared by the Liége Association of Engineers in celebration of its seventy-fifth anniversary. Amongst the visits on Monday was one to the Ateliers de Construction de la Meuse at Schlessin, under the guidance of the managing director, M. François Timmermans, and another to the Fabrique National d'Armes de Guerre at Herstal, conducted by the assistant director, M. Ferdnand Nepper. On Tuesday afternoon, the famous works of John Cockerill, at Seraing—where Messieurs Trasenster, Greiner and Gorsky were the hosts—formed the principal attraction. As only two hours were available for the inspection, little save the huge gas engines could be seen, but the visitors could not fail to be struck with the rapid recovery made by the great factory from the state in which the Germans had left it. Cockerills are now building regularly gas engines of 2500, 3500, and 5000 horse-power, and they have in their power station one huge four-cylinder engine of 10,000 horse-power at work, and another under construction. It is because the makers themselves use continually for their own needs these great engines that they have been able to acquire experience with them that is unequalled in the world. For a complete account of recent developments made by the company in this direction we cannot do better than refer our readers to the special article written for us by Professor Hubert, and printed, with many illustrations, in our issue of November 19th, 1920.

On the return to Liége a formal farewell to the Institution of Mechanical Engineers was pronounced by M. Gustave Trasenster and acknowledged by Dr. Hele-Shaw. It brought this long summer meeting of the Institution of Mechanical Engineers to a very pleasant conclusion.

Both in France and Belgium the gathering proved

* No. I. appeared June 23rd.

NEW COAL SHIPPING PLANT AT MARYPORT

F. TURNBULL AND CO., HEATON JUNCTION, NEWCASTLE-ON-TYNE, ENGINEERS

FIG. 1—FRONT VIEW SHOWING ANTI-BREAKER LOWERED

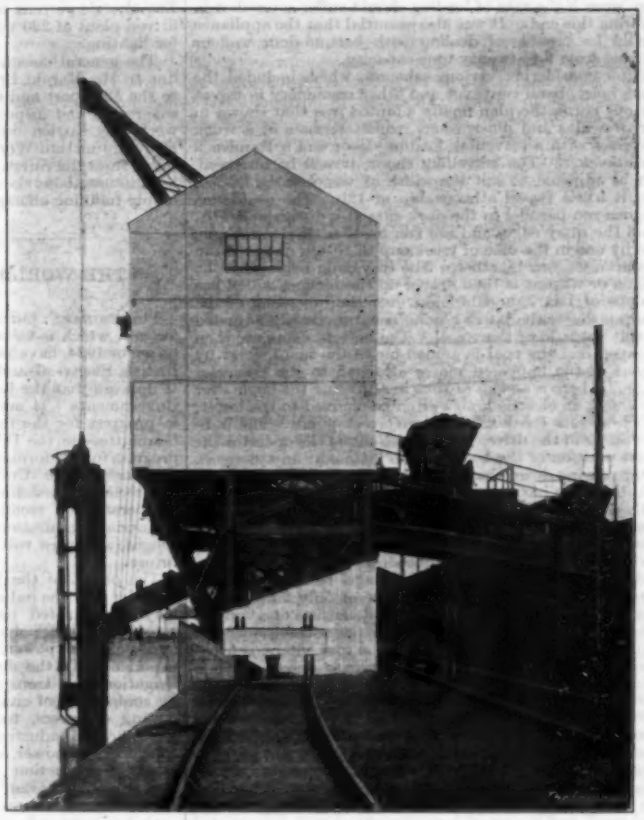

FIG. 2—SIDE VIEW SHOWING COAL CHALDRONS ON INCLINE

a complete success, and must have done not a little to cement the friendship existing between the engineers of the three countries concerned. Even in France, where the political atmosphere was regarded as threatening, the visitors met with nothing less than the greatest courtesy on all sides, and frequently with real cordiality. Our allies, indeed, took the opportunity to insist upon the intensity of their suffering during the war, and, in displaying their wounds, claimed their right to full reparation, but they did so with none of that acerbity which by some had been anticipated. If the political effects of visits of this kind is small there can be little doubt that good is effected by them since they give France and Belgium the opportunity of laying their case before British people, and since they give the latter the opportunity of acquiring at first hand, by observation and conversation, a fuller knowledge of the suffering and courage of their allies than could ever be obtained indirectly.

New Coal Shipping Appliance at Maryport.

THE coal-loading plant which is illustrated on this page was put into operation by the Maryport and Carlisle Railway Company a few months ago, and forms an addition to the coal-shipping facilities at the Elizabeth Dock at Maryport Harbour. There are several novel features in the installation which should prove of interest to coal shippers, and they have been introduced mainly

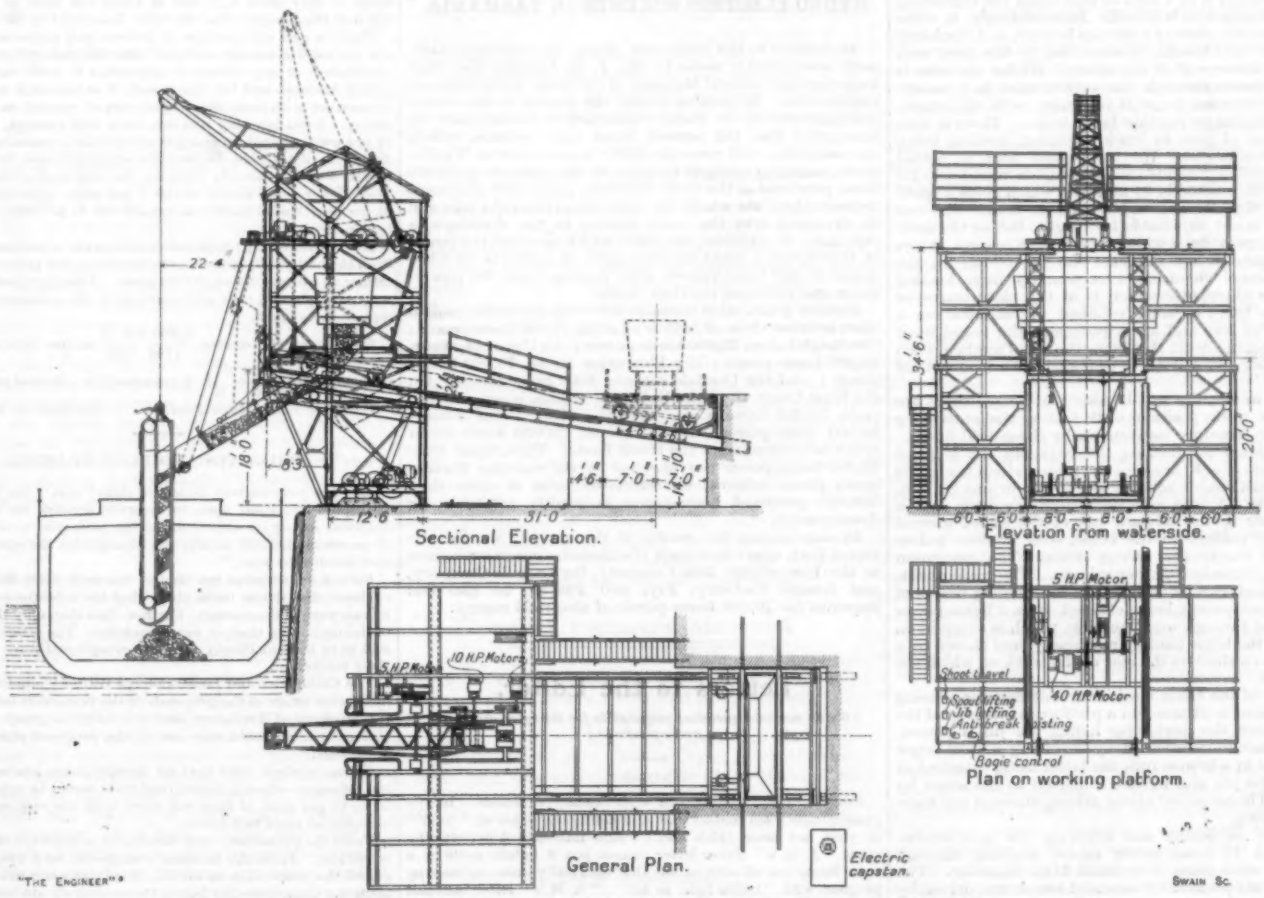

FIG. 3—ELEVATIONS AND PLANS OF NEW COAL SHIPPING PLANT AT MARYPORT

on account of the special local conditions and requirements. The question of preserving coal from breakage is now an important one on the West Coast as elsewhere, and the Directors of the Maryport and Carlisle Railway Company, the lines of which serve the dock, in instructing its engineer—Mr. Harold Brown—to prepare designs for the new work, stipulated that this point should receive special consideration, even if the rate of loading should suffer somewhat in securing this end. It was also essential that the appliance should be capable of dealing with bottom-door wagons ranging from 3 to twenty tons capacity.

After considering various schemes, which included the truck hoist, band conveyor and other machinery in use at various ports, the plan finally adopted was that shown in our drawings and illustrations, which consists of a truck traverser with a travelling loading shoot and a Handcock Anti-breaker. The travelling shoot, it will be observed, can be adjusted to suit the width of vessel to be loaded, and it has a travel athwartship of 12ft. The coal-laden wagons run parallel to the dock side at a distance of 47ft. from the quay edge, and are run on to a traverser bogie, one by one in the case of trucks up to 20-ton or two 3-ton chaldron wagons together. The travelling bogie with the wagon or wagons is then drawn up the incline, which has a slope of 1 in 7, and brought over the inner end of the loading shoot, the latter having been previously adjusted to suit the hold of the vessel. The bottom doors are then dropped and the coal is guided on to the main shoot by means of the hoppered plates attached to the traverser bogie. There is no loss of time in adjusting the bogie over the shoot, an electric limit switch being fixed to the latter, which arrests the bogie at the correct point. The indicator gear in the driver's cabin also shows the operator the exact position of the bogie on the incline at any moment. After passing down the inclined shoot, the coal enters the anti-breakage box and is lowered gently to the ship's hold with a minimum of breakage. As the heap of coal increases in height in the hold, the anti-breaker is gradually raised by means of the electric crane, an operation which is performed whilst loading is proceding.

A description of the anti-breakage box has already appeared in our pages—see our issue of July 2nd, 1915—but it may be explained briefly that it consists of a vertical tube of rectangular cross section, three sides being enclosed, whilst to the fourth side, at which the coal enters, is fitted a series of telescopic doors, the uppermost one of which is attached to the lower end of the shoot referred to. The interior of this rectangular vertical tube is occupied by steel plate trays fitted to a pair of endless chains revolving round sprockets fixed at the extreme ends of the apparatus. These trays receive the coal from the shoot and lower it gently and rapidly to the bottom of the apparatus, where it is deposited on the heap forming in the hold. The trays are actuated by gravity, that is to say, by the weight of the coal itself, and the speed is regulated and racing prevented by means of an automatic brake of the centrifugal type. The brake is operated by means of machine-cut steel gears driven from the upper sprocket shaft, and is enclosed in a dust-proof case. The apparatue can be raised or lowered, as already mentioned, independently of the shoot, and its position is adjusted from time to time so as to keep the drop from the end as small as possible.

The shoot is wide enough to receive the coal from the largest 20-ton truck or two small 3-ton trucks, and is capable of holding 6 or 7 tons of coal when the regulating door at the lower end is closed. It accordingly, in some measure, takes the place of a storage hopper, and discharge from it to the anti-breaker is controlled by the door, seen towards the lower end of the shoot. Whilst the coal is being thus passed through the anti-breaker in a steady stream, the traverser bogie is returning with the empty truck and bringing up another laden truck. There is thus very little loss of time in truck changing, loading being practically continuous. We understand that in actual tests under ordinary conditions a complete round-trip for a 20-ton wagon is made in 2½ minutes, which gives a speed of loading at the rate of over 500 tons per hour. The end of the shoot is not adjustable for height, but as the anti-breakage box provides a wide range in that respect, it was considered unnecessary to make the provision. In the case of a vessel requiring exceptionally high loading facilities, the old plant—which is of the plate conveyor type—can be used, it being retained in readiness as a stand-by. For fore and aft adjustment, the vessel itself is moved along the dock, that being the usual method, even when a loading plant itself is provided with longitudinal travel.

When not in use, the anti-breaker and hinged shoot are housed back to a position well within the stationary portion of the structure, as is shown by the dotted lines.

The machinery for hauling the bogie up the inclined gantry consists of a 40 horse-power motor which transmits motion through double helical gears to two drums 2ft. 3in. diameter each. A wire rope leads from one drum over a haulage pulley at the forward end of the plant, around compensating pulleys on the bogie, over another pulley forward and on to the second drum. The maximum speed of the bogie is 60ft. per minute. The main shoot, as before stated, can be adjusted to the varying beams of vessels, the movement being effected by a 5 horse-power motor driving through worm gearing, which is situated on the frame of the bogie haulage machinery, and thence by a chain drive to a shaft at the rear of the truck on which the shoot travels.

The whole of the crane machinery and that for housing the hinged shoot is situated on a platform at the top of the structure where the device for luffing the jib is placed. The luffing motion is effected by revolving a steel screw 5in. diameter in a bronze nut, the latter being attached at the rear of the jib, and motion imparted to the screw by means of a 10 horse-power motor driving through machine-cut spur gearing.

The tackle for lifting and lowering the anti-breaker consists of a 10 horse-power motor working through machine-cut steel gears to a drum 21in. diameter. The hinged shoot is operated by means of two drums driven by similar worm and spur gearing. All motions are equipped with solenoid brakes working on the first motion shaft. The bogie haulage and anti-breaker lifting motions are fitted with automatic mechanical brakes of the multi-plate type in addition.

The electric controllers are all grouped in the cabin on the lower platform level, together with the indicator gears showing the position of the bogie on the gantry and the position of the crane jib. The limits of all motions are automatically controlled in both directions, the current being cut off by limit switches which reset themselves on the motion being reversed. An electric capstan, of the foot-control type, is provided for bringing the trucks on to the traverser bogie, a foot pedal on the capstan operating the automatic cut-out control placed in the control cabin. The electric current is generated by a 72-kilowatt steam-driven plant of 220 volts, which also furnishes the current for lighting.

The general design and arrangement of the plant was due to Mr. Harold Brown, A.M. Inst. C.E., chief engineer to the Maryport and Carlisle Railway Company, who also supervised and inspected it during construction, and the work was carried out by Messrs. F. Turnbull and Co., Heaton Junction Works, Newcastle-on-Tyne. We understand from the railway company that the plant which has been in use about six months has given every satisfaction, amply fulfilling all expectations.

THE WORLD POWER CONFERENCE.

PRELIMINARY particulars of the World Power Conference, which is to be held at the British Empire Exhibition of 1924, have been received from the promoters, the British Electrical and Allied Manufacturers' Association. It appears that the list of "Representatives of Dominion Governments" is nearly complete, and negotiations are in progress for the formation of Councils and Executive Committees in the Dominions. Arrangements are also in progress for the formation of similar bodies in the following countries:—The United States, France, Italy, Spain, Switzerland, Scandinavia, and the Netherlands. The co-operation of technical and Scientific Institutions and industrial organisations in this and other countries is being sought, and a list will be ready for publication in the near future.

The object of the World Power Conference will be to consider how the industrial and scientific sources of power may be adjusted nationally and internationally: By considering the potential resources of each country in hydro-electric power, oil and minerals; by comparing experiences in the development of scientific agriculture, irrigation and transportation, by land, air and water; by conferences of civil, electrical, mechanical, marine and mining engineers, technical experts and authorities on scientific and industrial research; by consultations of the consumers of power and the manufacturers of the instruments of production; by conferences on technical education to review the methods of education in different countries, and to consider means by which existing facilities may be improved; by discussions on the financial and economic aspects of industry nationally and internationally; by conferences on the possibility of establishing a Permanent World Bureau for the collection of data, the preparation of inventories of the world's resources, and the exchange of industrial and scientific information through appointed representatives in the various countries.

HYDRO-ELECTRIC SCHEMES IN TASMANIA.

ACCORDING to the Melbourne *Argus*, an important statement was recently made by Mr. J. H. Butters, the Chief Engineer and General Manager of the State Hydro-electric Department. In making public the results of the water-power survey of the State, conducted in recent years, he announced that the present Great Lake scheme, which, on completion, will generate 60,000 horse-power at Waddamana, could be enlarged in scope by the addition of 13,000 horse-power from the river Shannon, generated at a point between the place where the river issues from the lake and its diversion into the canal leading to the Waddamana pipe line. In addition, the water which develops the power at Waddamana could be used again to generate an additional 50,000 horse-power, after passing from the power-house and rejoining the Ouse River.

Further practicable schemes derivable from the central lakes area are those of Arthur's Lakes, 10,000 horse-power; Chudleigh Lakes, 25,000 horse-power; the Upper Derwent, 80,000 horse-power; the Florentine River, 70,000 horse-power; and the Ousdale scheme, 8000 horse-power. On the West Coast, the Lake Rolleston scheme is estimated to yield 25,000 horse-power, and the King River scheme 65,000 horse-power. In the South, 20,000 horse-power could be derived from the Huon River. Thus, apart from 60,000 horse-power provided for by the existing Waddamana power scheme, an estimated total of more than 360,000 potential horse-power is readily available for development.

In announcing the results of the survey, Mr. Butters stated that, apart from such Waddamana power consumers as the Electrolytic Zinc Company, the Carbide Company, and Messrs. Cadbury, Fry, and Pascall, he had had inquiries for 20,000 horse-power of electrical energy.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

NOISE.

SIR,—I rarely trouble you with literary comment. In the present case I am moved to it on reading the letter of "A. M." in your last issue (16th inst.). Any intellectual person who reads "A. M.'s" clever letter cannot put it lightly aside as a mere humorous effusion or one that satirically links engineering progress with "trifles light as air." "A. M.'s" letter contains none of that Ruskinian reasoning which fails to envisage those practical industrial developments essentially necessary for the maintenance of increasing populations, even at the cost of scenic sacrifice, i.e., the beauties of Nature. Colliery tips, cinder heaps and multi-coloured mud need not necessarily be the perpetual concomitants of industrial life, nor are they actually everlasting disfigurements of landscape.

There is one point upon which I should like to enlarge in support of "A. M.'s" views, and I am sure many of your professional readers will be interested in it. All first-class professional men must necessarily have sensory nerves more acutely trained than those of unintellectual people. Hence, peaceful environment is essential for their mental operations. Most of your readers will have noted the horrible rattling and racking noises created by our tramcars in their electrical hurry through our streets.

I should like to ask this question: Are our mechanical engineers so incompetent that they cannot prevent these noises, or does the practice mean a designed attack upon our oral sense with a motive? It has always been recognised all over the world that the trade and market dealings of the people are the inseparable allies of noise. Not so the product of the mind. When an engineer designs a ponderous engine of great weight and succeeds in running it noiselessly and smoothly, he has achieved something of which he can be justly proud, for the mechanisms of Nature on the grand scale are always thus.

Can it be, then, that our municipal authorities during, let us hope, this brief famine of work are endeavouring to persuade the masses that employment is abundant—evidence thereof, abundance of noise! If so, I should like to remind them that cows do not calve at Charing Cross nor hens lay eggs at the Royal Exchange.

Some of the processes of the mind are more or less mechanical and effortless, but original thinking is impossible in our towns to-day, and as it is original thought that gives birth to new ideas, which, in their turn, materialise in employments, it is time that all street noises were the subject of investigation with a view to suppression. Moreover, if our country is to remain in the front rank it will have to provide attractive facilities for the recipients of new ideas, for it is upon these that all nations will be thrust more and more for the necessaries of life.

ERNEST FORREST.

Newport, Mon., June 20th.

THE CASE FOR THE ECONOMISER.

SIR,—A casual examination of the above article, appearing in your current issue, would give the impression that only in rare instances is an economiser a paying proposition; but a more careful survey reveals the fact that under ordinary load factors it proves to be an excellent investment.

According to the example and figures assumed by Mr. Frith, if an economiser commences to pay at a 10.0 per cent. "load factor," this means that the whole of the saving per annum after an economiser has worked 876 hours, or, for example, fifteen average weeks, represents absolute gain.

The actual saving in fuel is, however, much greater than estimated by Mr. Frith, for he has probably unconsciously fallen into the error of dividing the amount of heat transmitted through the economiser by the actual calorific value of the coal, whereas he should have divided the "heat transmitted" by the "useful" calorific value, *i.e.*, the calorific value multiplied by the efficiency of the boiler alone.

If the boiler without economiser had an efficiency of 70 per cent., the useful calorific value of the coal would be 8750 B.Th.U., and not 12,500 B.Th.U. as stated. In other words, Mr. Frith's figures N/C should be N/0.7 C, which makes a considerable difference, and alters the whole of his subsequent tables and curves.

With regard to the number of B.Th.U. transmitted per degree difference in temperature, in average present-day plants, this figure is very often 4.2, and at times has been as high as 5, which is much higher than the value 3 assumed by Mr. Frith.

There is also the question of interest and depreciation. It is not perhaps generally realised that the money saved by an economiser or any economic apparatus is itself earning compound interest, and for this reason it is incorrect to debit the economiser with even the normal rate of interest on the initial outlay. Even ignoring this fact, only half interest, or roughly 2½ per cent., should be charged against the economiser, because during its lifetime the depreciation sums deducted from revenue earned will be gradually reducing the outstanding debt to zero. This 2½ per cent. added to the 7 per cent. depreciation gives 9½ per cent. total charges, as against the 17 per cent. mentioned by Mr. Frith.

It is an interesting problem to work out the actual sum accruing from the half-yearly investments of savings due to an economiser during its average life of sixteen years. The aggregate amount is surprisingly great, even after putting by the necessary sum for a replace economiser.

Should not the figures $\frac{2{,}600{,}000\ N}{1786 - N}$ in the first column of page 636 read $\frac{2600\ N}{1786 - N}$? I presume it is a clerical error.

Hampton Court, June 22nd. GEORGE E. TANSLEY.

RAILWAYS AND ROAD TRAFFIC.

SIR,—In your current issue you state* that "the Ministry of Transport laid itself open to deserved censure for not having disclosed sooner its objections to the principle in which it was proposed in the Bill to levy the charges for the conveyance of merchandise by road."

Permit me to point out that it was only after Mr. Marriot's evidence that it was made clear what the intentions of the promoters were in the matter. Further, that then only the question of the maximum charges was considered. The promoters would still have been at liberty to quote exceptional rates lower than their maximum.

The Committee and Lieut.-Colonel Walter Guinness, as chairman, were aware of the proposals of the promoters before calling the Ministry of Transport, and yet failed to grasp the absurd position which would arise out of the proposed charges of the promoters.

These, in effect, were that for short-distance journeys—up to, say, 40 miles—the maximum road rates would be approximately 50 to 60 per cent. of their rail rates, with the option of quoting exceptional rates still lower.

From the promoters' own standpoint as railways the proposal is suicidal. From the hauliers' standpoint, as a proposed safeguard, the proposal is an insult. Surely any censure should fall upon the Committee for failing to see such an obvious fact, and not upon the Ministry of Transport for emphasising it at the first opportunity available to them.

CLEM CROSSELIN.

* The statement is not ours. It was made by the Private Bill Committee, presided over by Lieut.-Colonel Walter Guinness, and our own words—see page 691—are not correctly quoted by Mr. Crosselin.

A Seven-Day Journal.

The New Thames Guardship.

DURING the week a large amount of interest and curiosity has been shown towards the President, the new R.N.V.R. training ship, which came to her moorings between Blackfriars Bridge and Temple Pier on Wednesday evening, the 21st instant. The new guardship was formerly the Q boat Saxifrage, and was built in Renfrew in 1918, the Armistice intervening before she was put into service. Her boilers and engines have now been removed and a commodious wooden structure has been built on deck, which gives her the appearance of a Noah's Ark. A large deck space is available for parade purposes, and the gymnasium and signalling rooms are now being completed in addition to the accommodation for carrying out courses in searchlight, wireless, torpedo and gunnery instruction, the ship being furnished with both 4in. and 6in. guns. At the present time dockyard men are aboard refitting and rigging the ship, and it is expected that this work will be completed in about two weeks' time, when the President will form the headquarters of about 300 members of the R.N.V.R. Ultimately the vessel will afford accommodation for about 1000 men.

Royal Air Pageant.

THE R.A.F. aerial pageant, which was held successfully at Hendon on Saturday last, was of special interest, not alone on account of the spectacular display, but also because four new types of machines designed for naval and military purposes were shown for the first time. These machines included two of the very latest craft for naval service, a third was a special high-power single-engined plane for long-range bombing duties over land, and the fourth a fast aeroplane for fighting and Army reconnaissance. The Blackburn Dart torpedo carrier is specially designed for carrying out torpedo attacks on warships, the torpedo being accommodated beneath the fuselage, which is of special shape, giving the pilot a wide range of vision over the sea. The second naval type is the Seagull, an amphibian of the flying-boat type, with wheels which may be raised and lowered by the pilot. The ability of this machine to alight either on land or water forms a valuable asset for naval reconnaissance duties. The new Aldershot aeroplane, the long-range bombing machine, has a double deck, the two decks being connected by a ladder on the interior of the fuselage.

Concrete Lighters for Coal Traffic.

IT is announced that the fleet of concrete ships, consisting of about thirty large lighters and ten powerful steam tugs, all of which were built to the order of the Ministry of Shipping, has now been purchased by a well-known firm of London shipbrokers, who intend to maintain a regular service from the Tyne to London. The experiment is an interesting one on account of the conflicting opinions on the costs of operating sea-going lighters as compared with the economical Newcastle collier ships. We understand that, owing to the price at which the ships were obtained, the capital charges will be smaller than those of some of the other steamship companies operating on this route, but that, owing to the fact that the chance of accident is considerably increased, the insurance charges will be higher. A considerable saving in transport cost will be made if the lighter system permits more northbound cargoes to be carried, as with the present system practically every collier goes back to the Tyne light, which means a corresponding increase in the freight charge on the coal.

Edinburgh's New Super-power Station.

SATISFACTORY progress is being made with the construction of the new Portobello power station, which, when completed, will furnish power and light not only for Greater Edinburgh, but also for a supply area which will most likely include the three Lothians. The turbine house and the switchgear room are already practically completed, and the erection of the boiler-house is well advanced. The means which have been adopted to assure an abundant supply of cooling water for the condensers are particularly interesting. Three vertical shafts 9ft. in diameter have been sunk in the Firth of Forth to a depth of 60ft. and from the bottom of these shafts tunnels 4ft. 9in. in diameter have been driven seawards a distance of some 1500ft. to a point below low-water mark. At the sea end of each tunnel a vertical shaft is provided. In the course of normal operation two tunnels will be utilised as inlet shafts, and the heated water from the condensers will be discharged through the third at a temperature of upwards of 67 deg. Fah. Surface condensers are to be used, each condenser having about 5000 $\frac{3}{4}$in. diameter brass tubes of approximately 18ft. in length. About 840,000 gallons of water per hour will be required for each of the three 10,000-kilowatt turbo-alternator sets, which will generate three-phase current at a pressure of 6600 volts. The station is so designed that it may be extended to accommodate 100,000 kilowatts of plant. It is estimated that the total cost of the whole undertaking will not exceed £1,750,000, and the opinion has been expressed that, after allowing for interest and redemption of capital, it should be possible to generate and sell current at a price below that which it is necessary to charge with the existing plant.

The L.C.C. Tramways.

THE Highways Committee of the London County Council is nothing if not optimistic. Each year it estimates that during the following twelve months the tramways accounts will show a surplus, and each year it finds its prophecy unfulfilled. Last year, as usual, there was to be a surplus; actually there was a deficiency of £88,757, notwithstanding the fact that only half the cost of renewals was charged to revenue account. Nothing daunted, the Committee puts on a brave face and again foretells that receipts will more than balance expenditure; that actually there will be a surplus. In a report just made to the Council it is shown that the anticipated gross revenue for the year ending March 31st next is £5,214,665, while the total working expenses are put down at £4,410,595, which would leave a gross estimated surplus on revenue account of £804,070. When debt and other charges are deducted, there is to remain an "estimated net surplus" of £38,337. A great point is made of the fact that *all* the estimated cost of renewals is included in these figures, and not only half, as during the last few years. London ratepayers will hope that, for once, the Highways Committee's forecast may be correct, but in the light of past years' experience they will not be surprised if it is not.

Cammellaird-Fullagar Motorships.

REFERRING to a statement in last week's Journal regarding an electrically propelled fruit-carrying vessel, we can now state that Cammell Laird and Co., of Birkenhead, have received from the United Fruit Company, of Boston, U.S.A., an order for three insulated motor ships for the fruit-carrying trade. The vessels will be about 4000 tons gross, and they will be propelled by electric motors, the current being generated by Camellaird-Fullagar engines. This arrangement of machinery is entirely new, and far-reaching developments are expected. In addition to increased cubic space and deadweight capacity, a considerable saving in fuel consumption will be made, and a maximum flexibility of control will, it is claimed, be given. The building of these three ships should give considerable impetus to Fullagar engine developments.

The National Physical Laboratory.

THE annual inspection by the General Board took place at the National Physical Laboratory on the afternoon of Tuesday last. Over 800 guests accepted the invitation of the Board to participate in the inspection and they were received by Professor Sir Charles S. Sherrington, President of the Royal Society, and Professor Sir Joseph E. Petavel, the director of the Laboratory. Numerous exhibits had been arranged and in the aerodynamics department particular interest was shown in the wind tunnels, where at the present time experiments are in progress for measuring the distribution of pressure over the wings of a model aeroplane, the measurement of forces and moments on a large-scale aerofoil, and the discontinuous flow of air visualised by means of a smoke cloud. In the engineering department various new testing appliances were seen, while recent developments in measuring machines were shown in the Metrology section. The working of the William Froude National tank was also demonstrated.

Electrical Engineers' Memorial.

THE unveiling and dedication of the war memorial erected in memory of the members of the Institution of Electrical Engineers who fell during the war took place at the Institution building on the afternoon of Wednesday, the 28th inst. The memorial was dedicated by the Right Rev. Bishop Ryle, Dean of Westminster, and was unveiled by Air Chief Marshal Sir H. M. Trenchard, assisted by Mr. J. S. Highfield, President of the Institution, and the senior Vice-president, Dr. W. H. Eccles.

A New Combine.

WE learn that an agreement has been concluded between Sir W. G. Armstrong, Whitworth and Co., Limited, and the well-known makers of paper-making machinery, Charles Walmsley and Co., Limited, of Bury, Lancs. The Walmsley machines for the manufacture of newsprint are familiar, and particular success has been achieved with the new 232in. machines, which are the largest yet built and for which there is need of a larger output. Under the new arrangement we understand that the Openshaw works of Armstrong, Whitworth may co-operate in the execution of contracts. The London offices of the Walmsley Company will be at Sir W. G. Armstrong, Whitworth and Co.'s hydro-electric department at 8, Great George-street, Westminster, and the two firms will work in close connection.

Fire on Metropolitan Railway.

A FIRE took place at the Moor-lane sub-station of the Metropolitan Railway on Sunday evening, involving a stoppage of the traffic on the railways between Aldgate and Baker-street, and from Moorgate to Finsbury Park on the Great Northern and City Tube Railway. We learn that the fire was caused in the first instance by an internal short circuit in one of the transformers, which burnt through the tank. The burning oil spread into the building and caused a serious fire involving other apparatus. The work of extinguishing the fire was impeded by the dense volumes of smoke arising from the oil, and considerable damage was caused.

The Prince of Monaco.

THE Prince of Monaco, who died in Paris on Monday afternoon, not only earned a place in the foremost ranks of men of science, but was one of the founders of oceanography and the most generous patron that that science has ever had. His investigations included many voyages in the Atlantic, the Azores, the Mediterranean, and in Polar seas, and the collections made on these voyages led to the founding of the Museum of Oceanography of Monaco, which is unrivalled in its collection of specimens, and is provided with ample research accommodation, including a steamer which is at the disposal of the workers. The Prince also founded the Oceanographical Institute in Paris for the teaching of oceanography, and presented the building to the University of Paris, with an endowment. The author of numerous scientific writings, the Prince was well known in British scientific circles, and he was an honorary LL.D of Aberdeen and Edinburgh Universities, and a gold medallist of both the Royal Geographical and the Royal Scottish Geographical Societies.

Air Attack on Battleships.

IN reply to a question in the House of Commons, it was stated on Wednesday that it was proposed to carry out experiments on various methods of attacking capital ships from the air. The ships to be used are those due to be scrapped under the terms of the Washington agreement. We understand that for the preliminary experiments a monitor will be used, which does not fall under the Washington Treaty, but H.M.S. Superb, a battleship of 18,600 tons, launched in May, 1909, built at Elswick, and carrying ten 12in. guns will be used for the main experiments.

A New Type of Propeller.

RECENT trials have taken place in the Gareloch with a new type of propeller for the propulsion of light-draught cargo and passenger steamers with which William Denny and Brothers, of Dumbarton, are experimenting. The new vessel, which is a departure from the usual type, is fitted with two large vane wheels, one each side of the rudder. The wheels are provided with propelling vanes on their immersible circumference, and in the experimental ship they are driven by belt from an oil engine. On the trials a speed of about 9 knots was attained, and as the arrangement of machinery was provisional high speed was not aimed at, but the manœuvring powers of the vessel were tested. It was found that the ship could be turned smartly, was easily reversed, and could steer a sinuous course with ease and stop or swing in her own length by using one or the other wheel as required. The new system is claimed to be superior to paddle floats.

British Industry.

SPEAKING at a meeting convened by the National Union of Manufacturers on Wednesday, the Duke of Northumberland dealt with the continued depression in British trade and industry, and suggested a constructive policy to the Government. The resolutions moved by the Duke, and passed by the meeting, may be briefly summarised as follows:—The further reduction of national expenditure and the reduction of taxation; the reinforcement, in co-operation with France and the Allied Powers concerned, of the resolutions of the Reparations Commission; the speeding up of the procedure under Part II. of the Safeguarding of Industries Act; and a review of the present law relating to trade unions and trade disputes with a view to its amendment.

Developments in Power Station Design.

No. XXXV.*

THE protection of electrical machinery is one of the most important matters which have to be considered in designing a large power-house. Unfortunately, electrical machines cannot be made absolutely fault-proof, and it is essential that in the event of a fault occurring in a machine, it should be automatically isolated without affecting other apparatus that is in working order. Protective gear designed for this purpose should work as soon as the fault commences, it should only disconnect the faulty apparatus, and it should not be affected by faults external to the protective apparatus. By cutting out a machine as soon as a fault develops, the damage is localised, and the possibility of other machines overloading themselves by feeding the fault is avoided.

The fundamental principle upon which the Merz-Price circulating current system of protection is based is that when an alternating-current generator is operating under ordinary conditions the current in one part of a phase is equal to that in any other part of the phase; that is to say, the current at the machine terminals is equal to that in the leads from the respective phases to the neutral point. Applied to a transformer, the principle is best expressed by saying that neglecting losses the energy on one side is equal to that on the other side. But as soon as a fault develops, those conditions no longer prevail, and the difference between what may be called the entering and leaving currents is made to operate relays, which, in turn, operate the switches which disconnect the machine from the supply. This system of protection, and the Merz-Price balanced voltage system for feeders have, of course, been in existence for a considerable time. For the present, however, we shall confine ourselves to the circulating current system as applied to the protection of generators and transformers.

Two similar transformers having a suitable ratio are connected in the circuit on each side of the apparatus to be protected, and the secondaries are connected together by means of pilot wires so that under normal conditions a current proportional to the generator load is circulated in the secondary circuit of the transformers, the whole of the secondary electromotive force being utilised in overcoming the impedance of the circuit. The relays are connected across any two points of equal potential. When a fault occurs more current flows in the primary of one current transformer than in the other, with the result that the secondary current also increases and the vectorial difference between the two currents in the secondary windings circulates through the relay circuit, thereby operating the relays and tripping the circuit breakers. The transformers used with this system must be capable of providing the required output without alteration of ratio, and they should be balanced against one another.

Where the length of the pilot wires is great and their resistance is not negligible, and where the two sections of the pilot wire, as determined by the tapping points for the relays, are very different in respect of resistance, it may be necessary to employ a compensating resistance for levelling up the impedances in the two sections of the pilot wire, but unless the power required for the two sections differs by more than one volt-ampère a compensating resistance need not be employed. It is essential, in order to obtain full protection, that the apparatus protected should be earthed through a suitable resistance, for otherwise an earth on one phase in the protected area will not cause the protective gear to operate, and if a second earth develops on another part of the system the whole supply will be affected. With an insulated system it is also possible to have two earths on one phase without the gear operating. The earthing resistance should have a comparatively low value, for otherwise a large proportion of the winding will be unprotected. If a resistance is employed which will pass full load current with the phase voltage across it, and the relays are set to operate with 15 per cent. of full-load current, then only 85 per cent. of the winding is protected because a direct earth at any point which has not a normal potential to earth of at least 15 per cent. of the phase volts will not be able to set up sufficient earth current to operate the relays.

When the method is applied to a three-phase star-connected generator with an earthed neutral, two sets of three-current transformers are employed, so that either six leads must be brought out to the cubicles, or, as is more usual, the three transformers are placed at the neutral point in the generator pit. The generator protected should be fitted with an automatic field switch, so that as soon as a fault occurs the exciting circuit is automatically broken, thus reducing the fault current to a value which is simply dependent upon the residual magnetism of the generator. The switch should be connected between the exciter and the generator and not in the exciter field, as in the latter case the residual field of the exciter is utilised to generate an exciting current which assists the residual magnetism of the generator in the work of destruction. The standard setting for generator protection is 15 per cent. of full-load current with instantaneous operation of the relays. When dealing with the protection of a delta star or star delta connected power transformer the protective transformers are connected star delta and delta star respectively, or, in other words, in the reverse manner to the power transformer.

To make allowance for the large out-of-balance current which flows in the primary winding for a very short time at the instant of switching in the power transformer, the relays are shunted by means of kick fuses, which, being of very low impedance, take most of the out-of-balance current, and therefore prevent the relays operating every time the power transformer is switched in. These kick fuses are set to operate with 75 per cent. of the full-load current, and the relays for 7.5 per cent. of that current. As a protection against overloads, fuses are sometimes inserted in the pilot wires and arranged to blow at any required overload, thus breaking the pilot wire circuit and the circuit of the operating relays.

In all the foregoing applications it is essential that the relay setting should be rather coarse, so as to

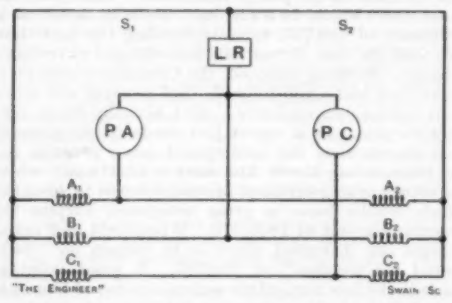

FIG. 228—CONNECTIONS FOR THREE-POLE RELAY

prevent them operating on a heavy overload, external to the protective apparatus. For the purpose of protection against faults between phases, this coarse setting does not, it is contended, matter, and it would be quite satisfactory to set the relays to trip when a fault current equal to the full-load current was flowing. For protection against earth leakage, it is important that the system should be very sensitive, and in order to secure this condition the arrangement shown in Fig. 228 has been patented by the Metropolitan-Vickers Electrical Company, which supplies the Mertz-Price protective gear and other protective gears, which will be described later. In Fig. 228, A_1, B_1 and C_1, and A_2, B_2 and C_2 represent the secondary windings of protective-current transformers applied to the protection of a three-phase generator, the primary windings being omitted for the sake of simplicity. Relays L R, P A, and P C form together a three-pole relay, and relays P A and P C are set for ordinary protection against faults between phases, whilst relay L R is merely an earth leakage relay, which can be set very much more finely than the other relays. Under normal conditions any out-of-balance current, such as the no-load current of a transformer, and not large enough to operate the relays P A and P C, will circulate through these relays, but not through the relay L R, even if, say, phases A_1 and A_2 have to carry an earth leakage current to some part of the system external to the protected apparatus. The currents set up in S_1 and S_2 will then be equal, and no resultant current will flow in L R. If, however, a fault develops inside the protected area, the currents in S_1 and S_2 will not balance one another, and a resultant current will flow through the relay L R and operate it. In all cases the earth leakage relay can be set to operate with a fault current equivalent to 7.5 per cent. of full-load current. The application of this modified system to transformers and generators is shown in Figs. 229 and 230 respectively.

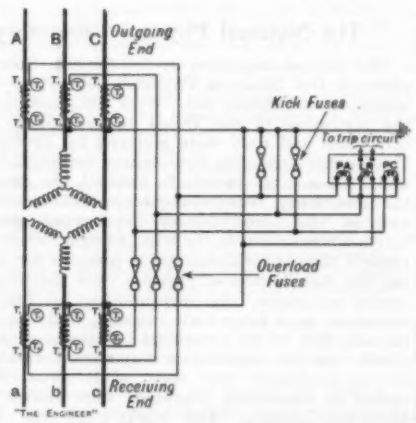

FIG. 229—PROTECTIVE GEAR CONNECTIONS FOR TRANSFORMERS

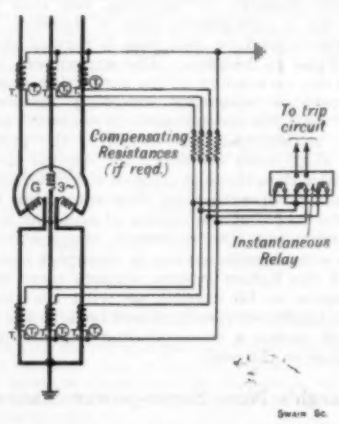

FIG. 230—PROTECTIVE GEAR CONNECTIONS FOR GENERATORS

The adequate protection of feeders comes next in importance to the protection of generators. Feeders convey the power from the generator to the sub-stations and consumers, and whilst the complete failure of one of the feeders would not cause a general shut down it would nevertheless cut off a number of consumers. Faults cannot be prevented by installing protective devices on feeders, but when faults occur their effect can be minimised by immediately isolating the faulty feeder and thus localising the damage and reducing the shock on the system as a whole. A protective system for feeders should have the same characteristics as that used for generator and transformer protection. The device employed should operate at the inception of the fault, it should be discriminative so that only faulty feeders are cut off, and it should not operate on a heavy overload such as may be caused by a fault external to the area it is protecting. Several systems will fulfil these conditions, and the problem of deciding which is the best to employ involves a careful survey of all the factors entering into the particular case under consideration.

The fundamental principle on which the balanced voltage system of unit feeder protection is based is that under healthy conditions, and neglecting losses, the current entering one end of a feeder is equal to that leaving at the other end, but as soon as a fault occurs this condition no longer holds, and the difference between the incoming and outgoing currents is made to operate a relay and open the oil switches which control the feeder. Two similar current transformers with a suitable ratio are connected together by means of pilot wires so that under healthy conditions, *i.e.*, with equal currents in both primary windings, the voltages of the two transformers are balanced one against the other, with the result that no current flows in the relays which are connected in series with the transformer secondaries. When a fault occurs, however, the currents in the two primaries will differ from one another either in phase or magnitude or both, and the secondary voltages will no longer balance one another, with the result that a current will flow in the secondary circuit and operate the relays.

The system is called a unit system because it is complete in itself, and balanced voltage protection can be applied to new parallel feeders without interfering with that on existing feeders. The transformer must be accurately tested as regards voltage and phase angle, and this can best be done by balancing each transformer against a standard, the balancing being carried out over a wide range of load to ensure that the characteristics of the transformers are similar. One of the disadvantages of the system is that the capacity current of the pilot wires flows through the relays. Under ordinary conditions of load the capacity current is very small, on account of the small potential difference between the pilot wires, and is insufficient to operate the relays; but under heavy overload conditions, such as will occur in the event of a fault external to the protected area, the capacity current may be large enough to operate the relays and so cut off the feeder. To prevent this happening the transformers are designed with a drooping characteristic, so that with large primary currents the ratio is larger than under normal load conditions.

The compensated balanced voltage system of unit feeder protection has been designed to overcome the disadvantage just described, namely, that the capacity current of the pilot wires flows through the relays and thus necessitates the employment of transformers with a drooping character. The compensated balanced voltage system is identical with the system just described, but the capacity current is shunted off from the relays. The shunt is obtained by providing the pilot wires with a metallic sheath which is divided at the centre of its length so as to form two separate conductors of equal length. When a heavy overload comes on a high potential is induced in the secondaries of the transformers and sets up a capacity current, which, instead of passing through the relays, flows in the local circuit formed by the sheath, transformer and pilot cable. The path of this current can easily be traced from Fig. 232, which shows the application of the system to a three-phase feeder, the

* No. XXXIV. appeared June 23rd.

result of shunting the capacity current in this manner being to enable the relays to be more sensitively set. Other advantages of the system are that transformers with a straight line characteristic can be more easily balanced, and owing to the shielding effect of the metallic sheath it is possible to place telephone cores in the pilot cable and thus enable a single large and strong cable to be employed instead of two relatively weak cables.

The action of the split conductor system of unit feeder protection is based upon the fact that if these two conductors of equal impedance are connected in parallel, then current will divide equally between them, provided there is no fault on either section. If a fault develops on one section, then that section will carry more current than the other, and this

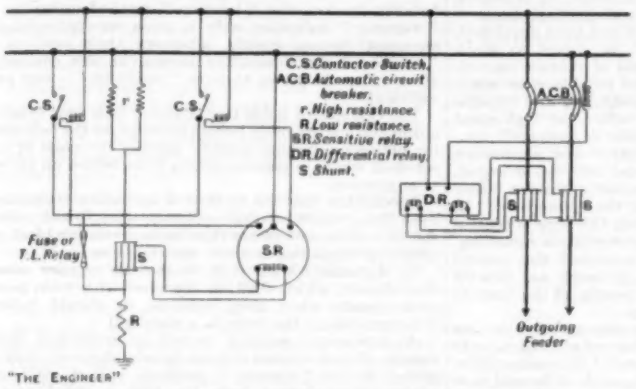

FIG. 231—AMPLIFIED CORE BALANCED SYSTEM FOR D.C. FEEDER PROTECTION

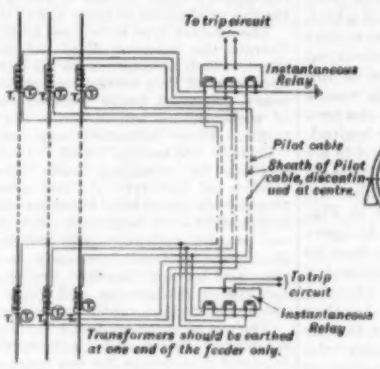
To trip circuit
Instantaneous Relay
Pilot cable
Sheath of Pilot cable, discontinued at centre.
To trip circuit
Instantaneous Relay
Transformers should be earthed at one end of the feeder only.

FIG. 232—COMPENSATED BALANCED VOLTAGE SYSTEM OF PROTECTION

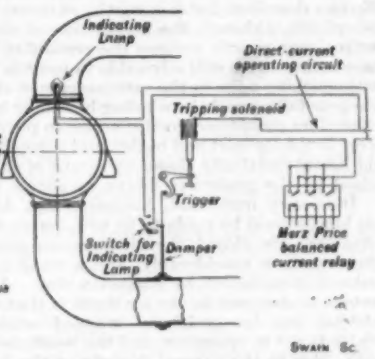

FIG. 233—ELECTRICALLY OPERATED DAMPER

inequality in the currents operates a relay and so isolates the fault. In applying this principle to feeder protection each conductor in the cable or overhead line is divided into two sections, which are lightly insulated from one another, and each conductor has as nearly as possible an equal impedance. At both ends of the feeder two sections of each conductor are passed through a ring transformer in opposite directions so that under healthy conditions, *i.e.*, with equal current in each section, no flux is induced in the iron core. But when a fault occurs the two currents are no longer equal and a flux is induced in the iron core, and this flux induces in turn a current in the secondary winding of the transformer, thus operating the relay and tripping out the main switch. In Fig. 234 the scheme is shown applied to a three-phase circuit, where it will be seen that the split conductors are carried right into the oil switch. This system is very sensitive, so that with a relay setting of 0.25 ampère it can be made to operate with a fault current of from 20 to 30 ampères, and it offers the additional advantages of being simple and reliable.

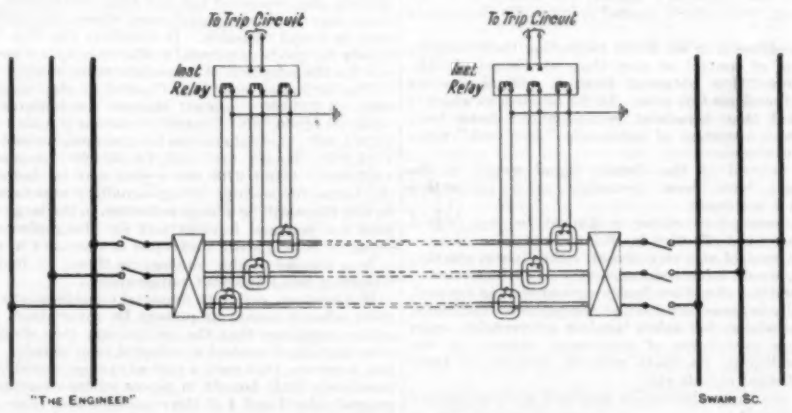

FIG. 234—SPLIT CONDUCTOR PROTECTIVE SYSTEM

For all new alternating-current work the Metropolitan-Vickers Electrical Company recommends the use of this split conductor unit feeder protection system, as it is claimed to be more sensitive and more simple than other protective systems. For new cables working at very high voltages one of the other two systems of feeder protection should be adopted, as insulation difficulties render split conductor cables uneconomical. For the protection of existing alternating-current feeders, the choice lies between the simple balanced voltage system and the compensated pilot balanced voltage system of unit feeder protection, neither of those systems requiring special cables or switchgear.

The action of the amplified core balance system of direct-current feeder protection for protecting direct-current feeders against faults to earth is based upon the fact that under healthy conditions the currents in the positive and negative leads are equal, but if a fault to earth develops on one pole and a return circuit is available for the current, then this balance will be disturbed, and the out-of-balance effect can circuit long enough for the fault to be isolated, it can be designed for a heavy current, and thus becomes comparatively inexpensive. The high resistance, or the "economy resistance" as it is called, may consist of lamps which will give an indication of the fault. The complete arrangement of connections for the system is shown in Fig. 231. If a fault develops on the generator or bus-bar circuits, the sensitive relay will still operate and connect the low resistance to the opposite pole to that which is earthed, with the result that a high fault current will flow continuously in the low resistance and probably burn it out. To prevent this occurring, however, a fuse or time relay is connected in circuit with the low resistance, and it is set to operate in the event of the current flowing in the circuit for a period substantially in excess of that required to isolate the feeder.

The McColl protective system, which has been introduced by the General Electric Company, of Witton, Birmingham, resembles the Mertz-Price system in that pilot wires are used. The current is, however constantly circulating through the pilot wires when the circuit is in use, and if either of the small wires is broken the current will, of course, cease to flow and the circuit breakers will be caused to open. The system offers the advantage that it gives consistent protection at all loads by means of a relay having a definite bias which causes it to act, not at a fixed current, but at a current which is a given percentage of the load current that happens to be flowing in the feeder at the time. Thus, if the bias is 10 per cent., the relay will operate when the leak amounts to 10 per cent. of the current flowing in the main circuit, irrespective of whether this current is the normal current or the overload current. The relay itself may be mechanically or electrically biassed.

In the latter case, an ohmic resistance may be connected to the circuit, or the proportions of the current transformers may be varied relatively to each other or by other means. There are many different schemes of connections involved in the McColl patents, and also several different forms of relays. The diagram—Fig. 235—shows, however, the General Electric Company's standard method of protecting feeders in accordance with this system. Current transformers are placed at each end of the feeder in the manner shown. It will be seen that in each case the secondary leads feed two branches, namely, the pilot wires and a duplicate circuit which is adjusted to have the same resistance as the pilot wires. The relays, it will be noticed, are of the plunger type, having a pivoted beam carrying a laminated plunger at each end. One of the plungers projects into a restraining coil in series with the pilot wire circuit, whilst the other plunger projects into the operating coil, which is in series with the duplicate circuit. The relay is biassed by supporting the beam on a fulcrum, which is displaced somewhat from the central position between the plungers, with the result that the restraining coil gives a greater leverage than the other coil. The relay contacts are attached to the right-hand end of the beam.

When the feeder is sound the secondaries of the two transformers give the same current and the two pilot wires and the two secondary windings form a closed circuit. Equal currents flow in the pilot wire and duplicate circuits, and equal currents, therefore, pass through the two coils of each relay. Under those conditions the relays do not close their contacts, but if a fault develops in the feeder between the two transformers more current will flow through transformer No. 1 at the power station end than passes through transformer No. 2 at the other end. The excess current, which does not circulate through the distant transformer, has two paths open to it, one being

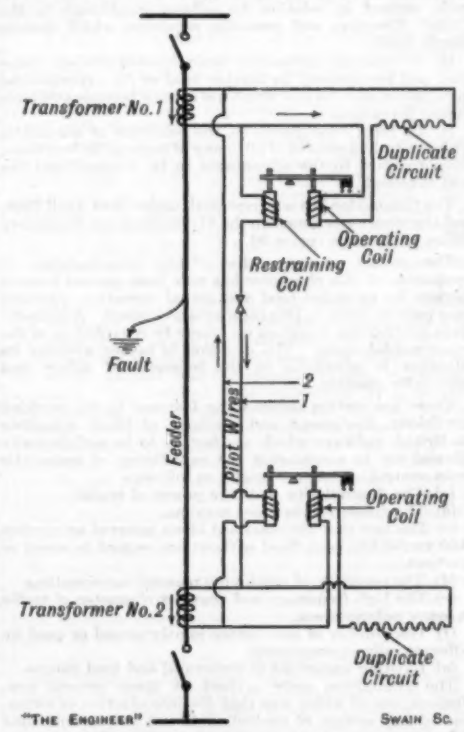

FIG. 235—CONNECTIONS FOR THE McCOLL PROTECTIVE SYSTEM

through the duplicate circuit at the station end and the other through the duplicate circuit in series with the pilot wires. It will be seen that the latter path offers three times the resistance of the former, so that three-quarters of the extra current will pass through the operating coil of the upper relay and a quarter through the restraining coil of this relay and the two coils of the other relay. The result at the supply end is that 75 per cent. of the extra current affects the operating coil and the relay therefore tends to operate, but is restrained by the 10 per cent. bias.

The effect of a 10 per cent. leak is, almost, to send exactly 10 per cent. more current through the operating coil at the supply end of the feeder than through its restraining coil, and the result of a 10 per cent.

leak is therefore to cause the relay to operate and to trip the circuit breaker. This condition holds irrespective of the load on the feeder, as the operating relay works on the basis of percentages and only operates when the excess current is 10 per cent. greater than the load current, irrespective of the actual value of this current. The load on the feeder can therefore increase indefinitely without any risk of the relays tripping the circuit breakers through a slight error in balancing the transformers. The transformers required are of the standard series type. Capacity current produces no detrimental effect, as it flows through the restraining coils and increases the stability.

A great deal of valuable information on the latest developments in protective gear for turbo-generators is given in Mr. Kuyser's paper, which was read a little while back before the Institution of Electrical Engineers and published in abstract in our issue of May 19th. We need not deal here with the systems which Mr. Kuyser describes, but it is worthy of mention that in his opinion, although the installation of electrical protective gear greatly reduces the possibility of fire in the windings, it is still advisable to provide means for extinguishing a fire in the extreme case of the protective gear failing and the winding becoming ignited. It is therefore considered good practice to provide air dampers in the air inlet and outlet, and these dampers should be automatically closed by means of solenoids energised by the protective relays, as shown in Fig. 233. It is very important, however, that dampers of this kind should be made to fit well, for as soon as the dampers are closed the air pressure generated by the fans rises considerably, and a small amount of leakage is sufficient to sustain a fire. Another advantage of dampers in the air ducts is that the air circulation can be positively stopped whilst the generator is not in operation, and the condensation of humidity due to the natural draught in the building can be avoided.

The Report of the Automatic Train Control Committee.

IN October, 1920, the Ministry of Transport appointed a Committee to consider the provision of automatic train control as a remedy against collisions arising out of drivers running past signals at "danger." The chairman was Colonel Pringle, and among the members were Mr. H. N. Gresley, of the Great Northern Railway; Mr. W. C. Acfield, the signal superintendent of the Midland; and Major Hall, one of the inspecting officers of the Ministry of Transport. The terms of reference were:—

(*a*) To enumerate the possible functions of automatic train control in relation to railway conditions in the United Kingdom and prescribe requisites which devices should fulfil.

(*b*) To examine automatic train control devices under trial and recommend for further trial or for experimental installation any devices which are or may become available during investigation.

(*c*) To form conclusions on the adoption of automatic train control, in respect of all or any of its possible functions, having regard to the advantages to be attained and the cost involved.

The Committee has now reported, under date April 20th, and the report was issued on the 21st instant as a Stationery Office publication (price 9d.).

The report observes that "The practicability of appliances of this character has now been proved beyond dispute by extended trial and actual operation, covering long periods, both in this country and abroad. Automatic train control can therefore no longer be regarded as in the experimental stage. The question is rather whether its adoption is expedient in the interests of safety and financially possible."

There are certain outstanding features in the working conditions, equipment and methods of block signalling on British railways which are factors to be satisfactorily allowed for in considering the expediency of automatic train control. They are briefly as follows:—

(*a*) The dissimilarity in brake power of trains.

(*b*) The differences in speed maxima.

(*c*) The fact that the standard block interval or overlap (440 yards) has been fixed without any regard to speed or gradient.

(*d*) The necessity of employing manual fog-signalling.

(*e*) The high frequency and complex character of traffic in many railway areas.

(*f*) The number of lines either jointly owned or used by different railway companies.

(*g*) Existing variations in structural and load gauges.

The Committee early arrived at three general conclusions, one of which was that the introduction or extension of any system of control could not be recommended unless a standard, in respect of track and locomotive apparatus, be first decided upon.

Devices aiming at automatic train control can generally be subdivided into two main types, viz., "continuous" and "localised;" the word "intermittent" is frequently used for the latter type of control.

(A) A continuous type of control aims at entire and constant protection of a train at all stages of its journey against *every* risk of collision. These devices are dependent upon complete track circuiting or its equivalent. The outstanding advantage of a control of this type is that it can be made to cover practically every risk which automatic train control can be expected to safeguard. But the Committee is opposed to it on account of initial and upkeep costs and because of its dependence on the supply of electrical energy to a train throughout its journey. No form of automatic train control can be considered wholly immune from risk of failure of that supply.

In the light of the foregoing disadvantages, the Committee is of opinion that expenditure to the extent necessary for continuous control would not be justifiable upon surface lines in Great Britain. On the other hand, in the case of an entirely new railway system, or on railways upon which appliances are less complete, or where accidents of a class preventable only by continuous control are comparatively common, this type of control might be worthy of consideration.

The attention of the Committee has therefore been directed to localised control, which supplements rather than replaces existing signalling and block telegraph systems.

(B) Localised control can be either of the "non-contact" or "contact" type.

The non-contact type is essentially electrical, and although it has the advantages consequent upon the avoidance of any physical contact between track and locomotive apparatus, it necessitates the use of somewhat complex electrical arrangements, entails a considerable addition to the skilled maintenance staff, and is likely to be more expensive, both in first cost and upkeep, than the contact type. There is also a difficulty in arranging for the production of more than two distinctive effects.

The contact type is the best known and most developed. Despite the inherent disadvantage, in regard to shock effect, which is common to all forms of contact control, apparatus of this nature has proved reliable after many years' operation under working conditions, and capable of withstanding satisfactorily the effects of high-speed traffic. Three indications can readily be provided, viz., "Clear," "Warning," and "Danger," and alternative methods for obtaining brake release can be arranged. Devices of this type do not necessarily require either primary or secondary batteries on the locomotive. In conjunction with local track circuiting, this type of control can be used with automatic and three-position signalling. Moreover, as track circuiting is extended the control exercised by any localised device, although not strictly continuous in character, will confer nearly all the benefits obtainable from a continuous system.

The use of speed control and time element relay devices is reported against, and it is shown that out of 163 accidents inquired into during the ten years ended September 30th, 1921, in only three, or 1.6 per cent., could it be said that a speed control device would alone have proved remedial.

Out of the 163 accidents just named, 71, or 36.8 per cent., mainly were caused by failure of enginemen, which some form of train stop or train control with automatic application could alone prevent or beneficially affect. Of these 71, 56, or 78.87 per cent., were of a type of accident preventable by localised or continuous control. Taking all accidents—those inquired into and those not—it is estimated that automatic train control would have a preventive effect, not obtainable by any other means, upon a yearly total of more than 100 cases.

There are two distinct schools of thought as to the relative value of train control at distant and stop signals. One, perhaps the older, school considers that the provision of control at distant signals is indispensable for safety, that it would prevent nineteen-twentieths of the accidents, and that control at stop signals is of quite minor importance. The other school regards control at stop signals as of first importance and control at distant signals as of secondary value.

The main points in the evidence may be briefly summarised as follows:—

(*a*) In respect of stop signals, the weight of evidence was in favour of control by means of a full brake application when "danger" was indicated, but against any audible indication.

(*b*) In respect of distant signals, a partial brake application combined with an audible indication was favoured by the majority for the "warning" position.

(*c*) There was unanimity against the utility of visual cab signalling, with which general opinion the Committee concur.

The Committee is in no doubt respecting the relatively higher value of control at stop than at distant signals. Further information obtained from a critical analysis of accidents confirms this view. In the 56 cases in which it is considered that beneficial results might have been expected from a system of automatic "localised" train control, it is shown:—

(i) That control at the distant signal would in the circumstances have been necessary as a preventive measure in 7 instances.

(ii) That control at either a distant or stop signal would have proved effective in 18 instances.

(iii) That control at a stop signal, either home, starting or advance, would have been necessary in 31 instances.

The Committee therefore finally agreed that in general, and especially in areas liable to bad atmospheric conditions, sufficient provision for safety against preventable train accident due to failures of enginemen cannot, in the existing conditions, be made without recourse to train control at distant signals also.

1. There are three alternative methods of train control at distant signals:—

(i) The first and simplest, which provides "location" effect, is to provide a track appliance fixed in character which shall give one and the same effect on locomotives whenever the distant signal is approached, irrespective of its position. Advocates of this method were practically unanimous that a brake application and audible signal should be combined for the desired effect.

As to the second, we need not quote what the report says, except that it is observed that if the track apparatus for the second method is movable in character there is the difficulty of operation, the greater liability to damage, and the necessity for detecting such damage, since a failure will be in the direction of danger. The Committee, having in view devices which have been brought to its notice, is not prepared to recommend the use of movable or partly fixed and partly movable apparatus for train control at distant signals.

The third method, advocated by a large majority—15 to 8—of the witnesses examined, provides train control in the direction of two separate effects for the "warning" and "clear" positions respectively. The "clear" effect to be an audible signal distinctive from that given for the "warning" effect, but with no brake application.

Regarded purely from the point of view of necessary additional security to supplement train stop control at stop signals, the first—"location"—method, which is also the cheapest, might, in the opinion of the Committee, prove adequate. But train control at distant signals should be considered in relation to manual fog signalling. The questions that arise are:—Will control prove an acceptable substitute for fog signalling; and, if so, what effects must train control produce to prove acceptable?

On the first point, though some of the witnesses expressed doubt, the answer was in the affirmative by a large majority of both officers and men. On the second point, it is clear, at all events in areas subject to fog, that train control must produce effect on all occasions when the train passes distant signals; otherwise one of their functions, *i.e.*, to give geographical information to enginemen of their whereabouts, will only be performed when these signals are passed in the "warning" position. With this minimum requirement both the first and last methods comply, but the second does not.

As a general rule the Committee considers that train control at distant signals, in order adequately to meet fog-signalling requirements, should provide distinctive effects for both "clear" and "warning" positions. Over large and well-defined districts, however, where there is no liability to fog, the "location" method, whereby the "warning" indication only is given on approaching all equipped distant signals, whatever their position—by "position" the Committee means, in this connection, what we would prefer to term "condition"—may prove sufficient.

The Committee holds that a *primâ facie* case exists for automatic control upon British railways, as the only means for obtaining greater security against the class of train accident which in general results from failure on the part of enginemen.

It considers that the method of automatic train control most likely to suit existing conditions upon British railways should supplement rather than replace existing block telegraph and signalling systems, and comprise:—

(*a*) Automatic train stop, located at or near selected stop signals, which shall, in the event of a train passing such signals when they indicate, or should indicate, "danger," bring the train to a standstill.

(*b*) Automatic warning control at unworked distant signals, also at worked distant signals whenever these are passed in the "warning" position, and at such other places where danger from too high a speed may be anticipated.

In addition to the above, which the Committee regards as the minimum necessary to obtain adequate security against train accident, it is held that the selected system of control should be capable of producing a distinctive audible effect for the "clear" position of worked distant signals, in order to meet conditions of fog signalling.

The report proceeds to set out twelve requisites. Of these the most interesting are:—That the brake application for either the "warning" or "danger" effect shall be capable of release by the driver, but that the action for releasing the "danger" indication shall be entirely distinctive in character from that required for the release of the "warning" indication. The "clear" effect shall be produced only when this condition is indicated both by the signal concerned and by the position in the locking frame of the corresponding signal lever; and in the case of automatic or semi-automatic signalling also by the condition of the corresponding track controls. The apparatus to be such that it will be operative when the locomotive is running in forward or backward gear, without involving any action additional to that normally necessary for reversing the direction of travel of the locomotive.

Having regard to the security afforded by single line token working, with interlocking of signals and relative tokens, and to the small number of accidents upon single lines, the Committee is of opinion that a case for the adoption of automatic train control upon single lines so worked and protected has not been established, although there may be a few special cases where eventually control may be found desirable. It considers also that lines used purely for goods or mineral traffic do not, as a general rule, call for the adoption of automatic train control.

The estimated cost is:—Control at stop signals: first cost, £1,295,000; annual charges for maintenance and renewals, £105,750. Control at distant signals: first cost, £3,365,000; annual charges for maintenance and renewals, £301,250. Total: first cost, £4,660,000; annual charges, £407,000. About £100,000 a year may be deducted from the latter for savings in fog-signalling expenses. Added to this there will be a large reduction in the large sums now paid for personal injuries and for the replacement and repair of rolling stock destroyed or damaged in accidents.

In a *résumé* of the conclusions there are included the following two important paragraphs:—

If, therefore, owing to financial considerations the complete scheme cannot at present be entertained, the Committee considers that the preliminary step should be the introduction of control at selected stop signals. It points out, however, that such a partial system would be of comparatively little benefit in places where exemptions from general rules 3 and 4 of the regulations for train signalling by block telegraph are permitted, and where the necessity for the "warning arrangement" cannot be obviated by the provision of outer home signals.

It recommends the immediate formation by the railway companies of a committee of experts to determine and standardise track and locomotive apparatus, having regard to differences in structural and loading gauges, and the position of conductor rails on electrified railways.

The report closes with an expression of thanks to the railway companies for assistance in various ways and of appreciation for the services rendered by Mr. C. Tilden Smith, the secretary to the Committee.

ACCORDING to the latest report of Mr. A. Adams, Commercial Secretary, H.B.M. Legation, Bucharest, one of the causes which hindered production in the oilfields of Roumania was the failure of the Society "Electrica" of Campina to provide electric current sufficient to enable the working of the wells, as well as boring operations, to be continued without interruption. Some of the oil companies have installed gas and steam engines for these operations and are thus independent of the electric supply. Another cause militating against development in the industry is the delay on the part of the railroad administration in paying for the petroleum products supplied to it.

Railway Matters.

TEN express passenger and ten express goods locomotives are to be built at Crewe, and some of the shops that have been working four days a week are now working five. The boilers are being made at Horwich.

REFERENCE was made herein on May 12th to the new lines of the Great Western Railway Company in the Swansea district. It is now announced that tenders for the construction of the Clydach and Pontardawe Railway—three miles long—have been invited.

THE Canals (Continuance of Charging Powers) Bill, referred to in this column of our issue of June 2nd, has been read a third time in the House of Commons, after an amendment had been agreed to that the increased charging powers shall remain until February, 1925.

THE cost of living having dropped at least 10 points since March, a reduction of 2s. per week under the sliding scale and of 2s. from the extra pay given in June, 1920, will be made from July 1st in the wages of those railway men whose rates have not yet reached the minimum.

COINCIDENT with the issue of the Automatic Train Control Committee's report comes an advice from Washington that the Inter-State Commerce Commission has confirmed its order to forty-nine railway companies to instal automatic train control devices on certain specified divisions before January, 1925.

THE Great Indian Peninsula Railway is establishing a transportation department. This, we assume, is an operating department wherein the movement of traffic is separated from the commercial side. It is said that the new department will obviate friction in many directions, traffic will be expedited, and a better use made of the rolling stock.

SPEAKING in Manchester last week, Sir Edwin Stockton, a director of the London and North-Western Railway, who was the chairman of the Manchester Chamber of Commerce, said that a substantial and early reduction in railway rates was the desire of the railway managers. Those people who were crying out for a change were pushing at an open door.

THE shocking accident on June 16th at Swansea, when a Great Western engine ran into a motor lorry, killing six men riding therein, was apparently caused by the youth in charge of the crossing going off duty before he was relieved. A verdict of "Accidental death" was returned. The crossing is on private property, and not on the Great Western Railway.

THE chairman of the Great Indian Peninsula Railway, speaking at the half-yearly meeting on June 23rd, said that he was hoping that the Government would make a decision shortly as to electrification, and if the decision were favourable the company would get to work as rapidly as possible on the new branch to Bombay Harbour. Owing to the gradients that line would be difficult and expensive to work by steam. The electrification of the Bombay suburban lines is an absolute necessity if the development scheme of the Bombay Government is to be a success.

A GOOD deal of discussion is going on in the Press as to names for the four groups of railways. The London correspondent of the *Manchester Guardian* has pointed out that "even a simple alteration in the initial letters sewn upon uniforms and caps may entail many thousands a year, quite apart from alterations to locomotives and rolling stock, stations, cartage, publications, stationery, &c., which no doubt will be carried out gradually; it is not, therefore, a matter of sentiment or of logical fitness, although these naturally enter into it, so much as a severely practical business problem."

THE quarterly returns of railway accidents are now appearing in their accustomed blue-book form, but not as "Command Papers." Those for the three months ended September 30th last have recently been issued. They are the reports on the Wapping, Dawlish, Southport, Drem, Selby, Newcastle, Hilda Junction and Leycett accidents, and their appearance has evidently been delayed by the late period—in April last—at which the last-named was issued. The assistant inspecting and sub-inspecting officers' reports are again being printed, and appear with the accident reports. There are, however, no quarterly returns of accidents.

IN this column of our issue of April 28th, we said that route-indicating signals had one disadvantage—they did not tell platelayers, shunters and others working behind them for what road the signal was lowered, and whether, therefore, they were in danger. Splitting signals without route indicators can be watched by these men, and as long as the arm leading to the line on which they are working is at "danger" they feel safe. A route indicator made by Siemens Brothers and Co., Limited, and fixed to the incoming signals for the up relief line at King's Cross, Great Northern Railway, has a new feature which meets this objection, as it gives an indication to the rear as well as to the front of the signal. It is worked electrically and can give up to twelve indications.

IN this column of our issue of November 29th, 1920, we mentioned that the Great Western Company was improving the access to Penzance Station, and particularly the viaduct over the sandy beach between Ponsandane and Chyandour. This work has now been completed, and from an article in the *Great Western Railway Magazine* for June we gather the following details:—The viaduct was opened in 1852, and consisted of fifty-one spans, averaging 19ft. in length, and with a clear width of 12ft. 6in. at rail level. It was always an obstacle to the development of through traffic to and from Penzance station, as it would not carry the modern locomotive, and engines had to be changed at Marazion. The viaduct has been rebuilt, and now carries a double line of railway. For this work two temporary sidings were laid direct on the beach, which, being exposed to tide and storm, were protected by barriers of granite blocks, and as they were submerged by every tide, were weighted by the same material when high tides prevailed. The widening is on the north, or land, side of the former viaduct, and on the site of the latter a granite-faced embankment has been constructed, which is surmounted by a parapet raised to a height of 3ft. above rail level.

Notes and Memoranda.

A RECENT experiment at Liverpool for disinfecting wool will, if successful, reduce the cost of sterilising from 1.5d. per pound to 0.25d. The new method employs a combination of the ultra-violet and X-rays, and may be used on baled wool.

SOME pictures in the *Engineering News Record* show a reinforced concrete bridge, having two arched spans of 60ft. each, of which the central pier settled 10in. during a flood of 1916. The bridge is still in service, carrying a heavy road traffic, although no repairs have been effected.

IN concluding a paper, read before the Mining Institute of Scotland, Mr. J. Wilson said that a great amount of time and research had been spent in determining the efficiencies of power, pumping, and ventilating installations, and there is little doubt that more attention ought to be paid in investigating the efficiency of one of the most important (if not the most important) installations of a mine, namely, the haulage.

ACCORDING to the *Electrician*, a successful experiment in wireless communication between the earth's surface and places in coal mines was recently made by a party of geologists and scientists in the Blue John Mine, Castleton. A receiving set was taken into the cave known as the Lord Mulgrave's Dining Room, about 280ft. from the entrance, and a quarter of a mile in any direction from the open. Here a 50ft. aerial was suspended across the cave, and with a small apparatus signals were received clearly from Poldu, in Cornwall, from a station near Berlin, and from other high-power transmitting centres.

A NEW machine, which is claimed to be a great advance upon anything that has so far been devised for mowing has been introduced by Tyzack, Sons and Turner, Limited, of Sheffield. The machine, it is reported, consists of two sickle blades, and the cutting is done by two sharp edges coming together. The knives are said to be practically self-sharpening. Perhaps the most important advantages claimed for the machine, however, are that it will cut cleaner and closer to the ground than the ordinary mower, and will remove "fog," or dead grass, which the average machine will not touch. If desired, the double-sickle blades can be attached to any mower, binder or reaper.

A NOVEL device, known as the Gerrard wire-tying system, for strapping chests is being introduced into the East, and a demonstration, given recently in Ceylon, has proved that it has many advantages over hooping. The essential feature of the device is the use of special ductile wire, which is strained at a high tension round the package, tied into a knot, and cut by a special machine. The knot cannot be untied, and no nails are used. The machine is quite small. The system is already well established in the Federated Malay States and Java; it is in general use among the biggest shippers in America, and also among large British firms. The cost is estimated to be slightly higher than that of hooping, but the extra security of the package should more than compensate for this.

IN a paper read before the Institution of Gas Engineers last week, Dr. Charles Carpenter, of the South Metropolitan Gas Company, pleaded for a wider appreciation of the importance of standardisation in the gas industry. The collective gas industry, he said, had never formulated standards with which the makers of fittings, burners, glassware, and mantles should be expected to conform, and the large number of unsatisfactory articles and appliances which were on the market to-day formed a serious menace to the stability of gas undertakings. The success of the electric light undertakings was bound up with standard lamps and fittings, and the gas engineering profession must take its due share in perfecting the uses of gas and widely spreading the knowledge of them.

COKE-OVEN gas was turned on recently from the Maritime coke ovens of the Great Western Colliery Company to the Treforest gasworks of the Pontypridd Urban District Council. The coke ovens (a battery of thirty-two) are 2 miles from the gasworks, and the gas is conveyed by a 4in. high-pressure welded steel main. By the adoption of high pressure, a saving of £7000 was effected. The cost of installing compressors was borne by the Colliery Company. Two Ingersoll-Rand compressors are installed at the coke ovens, an anti-fluctuator, set to 3in. pressure, being fixed on the inlet to the compressors. At the coke-oven end of the high-pressure main two governors capable of giving an inlet pressure of 5 lb. to 100 lb. are installed, and at the gasworks two duplex sensitive governors are provided with a range of 30 lb. down to 1in. pressure.

SOME interesting old pumps have just been superseded by modern plant in British Columbia. The old sets, which were capable of handling 13,000 gallons per minute against a head of about 9ft., and were used for reclamation work in the Lower Fraser River valley, were, according to the *Contract Record*, designed by a man named Menge, and put into service some twenty-seven years ago. They were constructed largely of wood, and were really a type of centrifugal pump with a cast iron impeller and vertical shaft enclosed in a square wooden casing, with boxing, wooden guide planks and ports placed so as to allow the water to enter both from above and below the impeller. With this type of pump it would, of course, not be feasible to attach a suction pipe. The two new units are of the Rees-Roturbo type, and can each discharge 23,000 gallons per minute against a head of 10ft.

ACCORDING to *The Times* Engineering Supplement, there is in Europe only one example of a sub-station with a completely developed automatic mechanism. This is used on the tramway between Basle and Lorrach. The equipment consists of a single 250-kilowatt rotary converter which transforms three-phase current at 6300 volts to direct current at 600 volts. The necessary operations for starting and stopping are effected by a combination of relays, contact appliances and electrical remote control devices on the different switches. The electrical mechanisms that control the switches are positively connected with each other, and are divided into a connecting system and a disconnecting system, each of these systems being again divided into several groups. The connections are such that on starting or stopping work the switches always come into connection in the sequence required.

Miscellanea.

IT is the intention of the Canadian Government to send an exhibition train through France this year. Both agricultural and industrial exhibits will be shown, and it is expected that Canadian manufacturers will aid in outfitting and defraying the cost of the train.

THE Swiss National Council approved, on June 27th, an amendment to Article 41 of the Law governing hours and conditions of labour in factories, providing that in time of grave economic crisis the working week may be fixed at fifty-four hours. The amendment is to remain valid for three years.

THE fifth Swedish National Fair will be held at Gothenburg from July 3rd to 9th next, where products of industries and handicrafts from the whole of Sweden will be represented. This Swedish Fair is the only one officially recognised, and as such enjoys a grant from the authorities. The four preceding Fairs have all been very successful, and there is every prospect that the forthcoming Fair will produce even better results. Only Swedish productions will be exhibited.

THE Council of the Royal Society of Arts attended at Clarence House, St. James's, on Thursday morning, June 29th, at eleven o'clock, when his Royal Highness the Duke of Connaught and Strathearn, President of the Society, presented the Albert Medal of the Society for the present year to Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., "in recognition of his important contributions, both theoretical and practical, to the development of the internal combustion engine."

THE Havas Agency learns that the Inter-Ministerial Commission which was appointed to inquire into the programme of public works submitted by M. Le Troquer, Minister of Public Works, has concluded the first part of its labours. The works recommended involve an expenditure of five milliard francs upon improvements on the Rhone, and the Dordogne, and the canals of the Sarre, the Meuse, and the Scheldt. These proposals will be discussed by the forthcoming Council of Ministers.

WE are asked by the Institute of Physics to say that a great many persons who have received a copy of the preliminary number of the proposed *Journal of Scientific Instruments* and who may wish to support it have not yet filled in the form inserted in the *Journal*. It is hoped that all who intend to subscribe will inform the Institute without delay, so that an estimate may be formed of the support which may be relied upon. It will be impossible to issue the *Journal* unless sufficient support is ensured.

A LARGELY attended meeting of Members of Parliament supporting the Channel Tunnel project (who number 400 altogether) was held at the House of Commons last Tuesday evening, with Sir Arthur Fell, chairman of the Channel Tunnel Committee, presiding, to consider the position of the scheme. General Surtees, General Sir Hunter-Weston, and Colonel Freemantle supported a resolution in favour of urging the Government to provide opportunity for a debate on the subject during the present sittings if possible.

A WEEK or two ago Paris was threatened with a lack of water owing to the hot weather and the exhaustion of the reserves. Now the city may lack water for a different reason. The employees of the Paris water company have for some time been negotiating with the management and with the competent authorities of the city of Paris, with regard to improved conditions for the suburban workers. The latter having been accorded an increase in their wages, the affair appeared settled, when the workers employed within the city decided to demand a similar increase. A resolution voted at the conclusion of a meeting at which a report on the situation was read by the secretary-general of the union, declared that if the city workers did not receive satisfaction, a general strike would be ordered.

SPEAKING at the meeting of the Johannesburg Chamber of Mines on June 26th, the Acting President, Sir Evelyn Wallers, dwelt on the improved economic basis which had followed the recent upheaval, the most important factor of which, he said, was the re-establishment of managerial control. He declared that there was no intention of adopting an unreasonable attitude towards the employees, but the mine managers must be masters in their own house. The reduction of working costs had now become possible, and there was a promise of a return to the pre-war figure of 17s. per ton at no distant future. Such a reduction would bring within payable limits 228 million more tons of ore for the present producing companies and 300 million tons more in other areas. One step was still necessary to place the industry on a permanent sound basis. That was the removal of the embargo on tropical natives. Incidentally, Sir Evelyn Wallers pointed out that the mining industry would have to pay practically the whole of the tax on employers of labour, notice of which was recently given by the Administrator.

ANOTHER project for extremely long-distance radio communication has been undertaken by the Radio Corporation of America for connecting New York with the Argentine, a distance of 4500 miles. The recently opened Radio Corporation station near Port Jefferson, Long Island, will form the New York terminal for this service, and will also communicate with points in Europe. This station, when fully completed, will probably be the most powerful in the world. It will be in reality twelve stations in one. The twelve antennæ radiating from the central power-house like spokes of a wheel are each suspended on six towers 410ft. high, carrying spreaders 150ft. long for the support of the sixteen wires of the antenna. The distance between the towers is 1250ft., making each of the antennæ about 1.5 miles long, and the total area covered by the system nearly 10 square miles. It is stated that there will be ten 200-kilowatt Alexanderson high-frequency alternators to supply the antenna currents. It is intended to use the different antennæ for separate services when transmitting conditions are favourable, but when required all can be thrown in parallel so that the power of 2000 kilowatts and an antenna current of 2000 or 3000 ampères will be available. At present two of the antenna units with their two alternators are in service.

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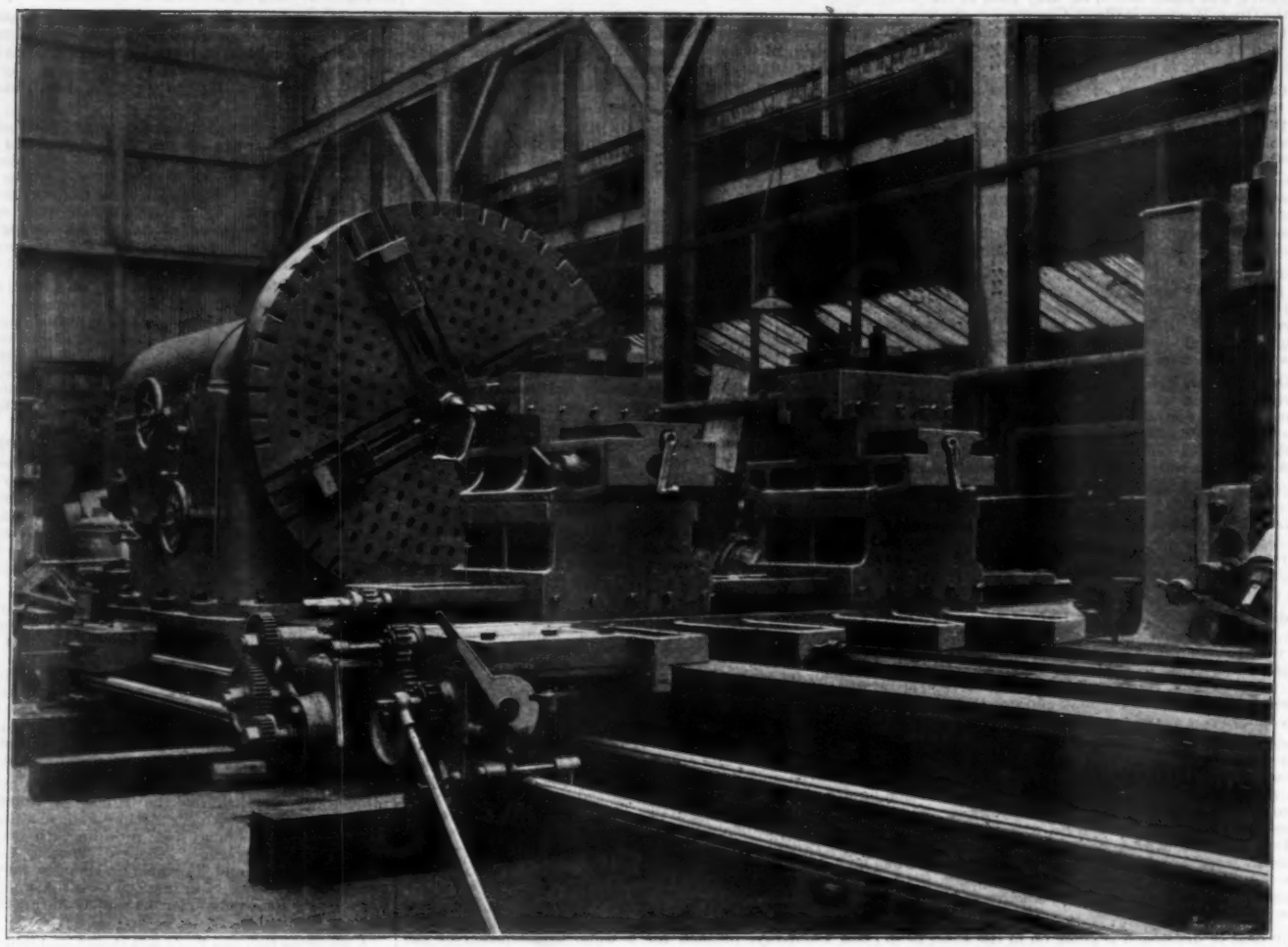

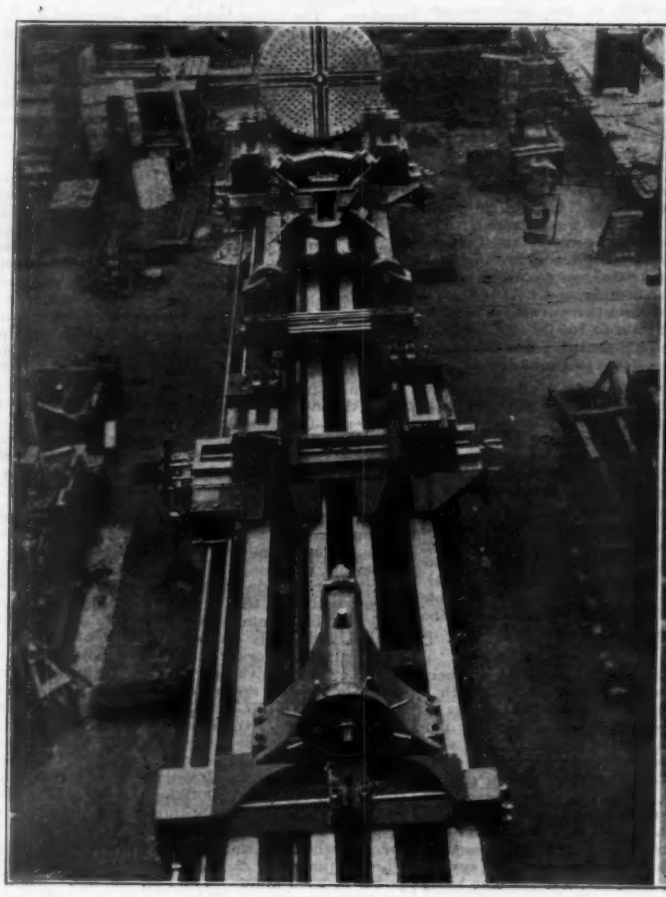

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Contents.

THE ENGINEER, June 30th, 1922.

	PAGE
ELECTRIFICATION OF THE CHILEAN STATE RAILWAYS. (Illus.)	711
INSTITUTION OF MECHANICAL ENGINEERS. No. II.	714
NEW COAL SHIPPING APPLIANCE AT MARYPORT. (Illus.)	715
THE WORLD POWER CONFERENCE	716
HYDRO-ELECTRIC SCHEMES IN TASMANIA	716
LETTERS TO THE EDITOR—]	
Noise	716
The Case for the)Economiser	716
Railways and Road Traffic	716
A SEVEN-DAY JOURNAL	717
DEVELOPMENTS IN POWER STATION DESIGN. No. XXXV. (Illus.)	718
THE REPORT OF THE AUTOMATIC TRAIN CONTROL COMMITTEE	720
RAILWAY MATTERS	721
NOTES AND MEMORANDA	721
MISCELLANEA	721
LEADING ARTICLES—	
Automatic Train Control	723
Pioneer Electrical Engineering	724
CHINESE ENGINEERING NOTES	724
CONVERSAZIONE OF THE INSTITUTION OF CIVIL ENGINEERS	724
THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION	725
BOOKS OF REFERENCE	725
LITERATURE	726
CHARGING MACHINES FOR CUPOLAS. (Illus.)	727
A NEW FORM OF PAVEMENT	728
MOTOR ROAD ROLLER WITH ATTACHED SCARIFIER. (Illus.)	728
THE PERSIAN MARKET FOR ENGINEERING PRODUCTS	728
A NEW FRENCH AGRICULTURAL TRACTOR. (Illus.)	729
EDUCATIONAL INTELLIGENCE	729
A LARGE ALL-GEARED DOUBLE-BEDDED LATHE. (Illus.)	730
ELECTRIC TRACTION IN SWITZERLAND	730
PROVINCIAL LETTERS—	
The Midlands and Staffordshire	731
Lancashire	731
Sheffield	732
North of England	732
Scotland	733
Wales and Adjoining Counties	733
LATEST NEWS FROM THE PROVINCES	733
CATALOGUES	733
CURRENT PRICES FOR METALS AND FUELS	734
FRENCH ENGINEERING NOTES	735
BRITISH PATENT SPECIFICATIONS. (Illus.)	735
FORTHCOMING ENGAGEMENTS	736
PERSONAL AND BUSINESS ANNOUNCEMENTS	736
PARAGRAPHS—	
The Institution of Municipal and County Engineers	733
Contracts—Royal Aeronautical Society—Train Resistance	736

THE ENGINEER.

JUNE 30, 1922.

Automatic Train Control.

THERE are certain features about the report of the Automatic Train Control Committee which we cannot but admire. Contrary to what has been done in the United States, where every conceivable obstacle and condition has been sought and remedies provided—or asked for—to meet them, Colonel Pringle's Committee evidently aimed at simplicity and the minimum requisites. What is known as continuous control—which, as the report says, "can be made to cover practically every risk which automatic train control can be expected to safeguard,"—might, on that ground, have been recommended; but since it requires the use of comparatively delicate locomotive apparatus, the Committee decided against it. Again, control by induction has advantages consequent upon the avoidance of any physical contact between track and locomotive apparatus; but since it necessitates the use of somewhat complex electrical arrangements, entails a considerable addition to the skilled maintenance staff, is likely to be more expensive, both in first cost and upkeep, than the contact type, and presents difficulty in arranging for the production of more than two distinctive effects, the Committee does not recommend its adoption. Finally, speed control and the use of time limit relays are considered quite unnecessary, nor is it thought requisite to provide control to guard against derailments due to unsuitable speed over sharp curves and to avoid buffer-stop collisions. All these superlative systems are eliminated, and what is recommended is some form of contact at the distant signal which will give one kind of audible signal when the distant is "on" and another kind when it is "off," together with an unmistakable brake application when that signal is "on" and no brake application when it is "off." At stop signals the control is to be of a simpler and less expensive character, the track element preferably being of the mechanical movable trip type, which, when at "danger," shall give a full application of the brake. Visual cab signals are considered unnecessary. The Committee appreciates the necessity for standard track and engine equipment so that locomotives can be controlled when running on their own or on "foreign" railways, and suggests that the companies should appoint a committee of experts to determine standard apparatus. In the appendices are given details as to how the estimated cost of £4,660,000 for the installations and £407,000 a year for upkeep is arrived at.

When, however, we come to the crux of the question, as summed up in paragraphs (I.) (II.) of the *résumé* of conclusions on page 25, we do not find ourselves in accord with the opinions of the Committee. To the broad principle of automatic train control as a remedy against drivers passing signals at "danger" we raise no objection; in fact, we have ourselves advocated it for years; but we do not think it can be said that, with our present accident record, "a case for the installation of control on British railways has been made out." Yet since, as Sir Sam Fay observed at the Institute of Transport Congress, it may happen that the cycle of accidents due to drivers passing signals returns, let us grant that it would be well to guard against such a possibility. Furthermore, we are ready to concede that fog conditions, bigger boilers, heavier trains, higher speeds, &c., call for something to mitigate the greater present-day responsibilities of drivers; but, allowing for all these things, there is, we submit, no necessity to go even as far as the Committee recommends. Neither can we agree with the Committee that control at stop signals is superior to control at distant signals, and we find little justification for the statement that "The practicability of appliances of this character has now been proved beyond dispute by extended trial and actual operation covering long periods, both in this country and abroad." We venture to ask "Where?" There has been little experience in this country, and not much more in the United States, of automatically pulling up trains at stop signals on steam railways. Of the only systems in general use here—on the Great Western, North-Eastern and Great Central—only the last-named employs control at the stop signals, and the experience on it has been gained with twenty locomotives over 42 route miles during seven years. Can that be described as "extended trial"? Agreed that there is control at the stop signals on electrically operated railways. But has it furnished positive knowledge as to what would be the effect of a full application of the brake on a heavy passenger train travelling at speed or upon a long goods train of unbraked wagons? We confess to belong to what the report says is perhaps the older school of thought, and to share the view "held very strongly by some of its advocates" that, if observation by enginemen of distant signals can be secured, security would result in nineteen-twentieths of the accidents. The distant signal has always been recognised as the most important signal; it is the index to the situation. Control at distant signals has, unlike control at stop signals, "been proved beyond dispute by extended trial and actual operation"—the Great Western has used it for sixteen years and it is now employed on 200 miles with one hundred engines fitted; the North-Eastern has had it for fifteen years and it is now emplnyed on the whole line between York and Newcastle, with some sections of four lines of way, and is fitted to 75 per cent. of that company's engines. Control at the distant signal would ensure to a driver, were the signal at "clear," an audible intimation of that fact, and, if it were "on," an audible signal of a different character, as well as a service application of his brake, which he could then, did he so wish, release. Another important factor is that, whilst the apparatus at the distant signal is used for every train, that at stop signals would come into action only on the very rare occasions when a driver overran a signal. Could we rely on such emergency apparatus being in order when the emergency arose? But even whilst we admit that control at the "distant" would be useful, we cannot find sufficient cause to justify the expenditure of the three and three-quarter millions it is estimated it would cost.

It is only by following the common fallacy of concentrating attention on defects and overlooking merits that any radical departure from the British system of railway signalling, for general purposes, can be found essential. The train accident record of this country, as we have shown over and over again, is admirable, and it may well be asked if any modification of it is likely to produce an actual improvement. In no human affairs can we hope to reach an efficiency of one hundred per cent., and there is no manner of doubt that some accidents in some way or another will continue to occur even if the recommendation of the Committee be adopted. The Committee, in an inquiry extending over the past ten years, could only find a total number of seventy-one cases, investigated by Government, which could have been "prevented or beneficially affected by some form of train control." A little more than seven cases per year does not appear to give much scope for improvement. The Committee indeed raises the seven up to one hundred in which automatic train control would have had a preventative effect. But the bulk of these accidents would be on goods lines and of minor importance and to material only, and it is questionable indeed if it would be worth while spending nearly five millions of capital

and over £400,000 per year in upkeep to prevent them. On the whole, therefore, the report leaves us cold. No crying necessity for automatic control has been proved, and in the circumstances we suggest that the right course is to leave the companies free to act in that way which seems to them best and wisest. Where control is really needed they will apply it themselves—as on crowded electric railways—where it is not needed they will omit it. In that way safety will be secured just as well and more economically than by compulsory adoption.

Pioneer Electrical Engineering.

Now that the "Proceedings" of the Institution of Electrical Engineers' commemoration meetings have been published, those who are interested in the history of electrical engineering have at their disposal an excellent collection of reminiscences appertaining to the achievements and misfortunes of the early pioneers. Any attempt to cover the work of fifty years in the course of a few meetings, extending over a period of three days, must necessarily result in a record which is far from complete; but the 120-page volume of the "Proceedings" which has just reached us is, nevertheless, quite an interesting and instructive publication, and much credit is due to Mr. J. S. Highfield, the president of the Institution, for suggesting that these commemoration meetings should be held. One thing which can scarcely fail to impress those who read the speeches which were delivered on that occasion is that, although electrical engineering is now progressing rapidly in practically all civilised parts of the world, the credit for the early work which has led to all modern achievements belongs very largely to British scientists and engineers. After the remarkable discoveries of Faraday, which were dealt with so admirably by Dr. Fleming in his lecture delivered at the opening meeting, subsequent progress was dependent in no small measure upon the ingenuity and perseverance of engineers in this country, where in the early 'eighties electrical engineering was more advanced than anywhere else. The construction of the Deptford station was an achievement which is worthy of far more general recognition than it has received, for it is well known that it was the first really high-tension station in the world. It has been said, and perhaps rightly, that the Deptford station was twenty years before its time; but to-day everyone agrees that the only way to distribute electricity over wide areas is by means of the high-tension system which Dr. Ferranti adopted thirty-five years ago. There is no doubt that Mr. Partridge was right when he said in the course of his remarks at the meeting held on Thursday, February 23rd, that, considering the extraordinary pioneering work carried out and the large sums of money spent, it seems a great hardship that this country as a whole should not have benefited more as a result of that work. During the time all the trouble was being experienced at Deptford other countries looked on, but as soon as they saw the advantages of the high-tension system they were not slow to adopt it.

Still, looking back on the early days and the odd electrical installations that were then in existence, it is doubtful if electrical engineers were less happy and contented than they are at the present time. Compared with the old generating stations, with their massive engines and rope-driven generators, the modern station is a tame and uninteresting place, in which there is little chance of getting much excitement. As Mr. Chattock remarked in relating his experiences, the life of a shift engineer at the present time must be a humdrum experience compared with what it used to be in the pioneering days. The elements of risk and excitement have to a large extent disappeared from electrical engineering, although the scope and opportunities for young engineers have been vastly increased by the new uses to which electricity has been put. Within the time the Institution of Electrical Engineers has been in existence the industry has made extraordinary strides, and what the next fifty years will bring forth no one can prophesy. On past history electrical engineers, and especially those in this country, can say a great deal, but in connection with future developments speculations are very liable to fall a long way short of actualities. Who would have imagined, say, ten or fifteen years back, that wireless telephony would have been placed at the disposal of the community at large or that it would have been possible to find the position of ships and aeroplanes by means of wireless direction finders? Bearing the remarkable developments of recent years in mind and taking into consideration the large body of young and highly trained men who are now engaged in the various branches of electrical engineering, it is difficult to visualise what the future holds in store. Several speakers at the Institution of Electrical Engineers' commemoration meetings referred to the great ignorance which prevailed in the early days. When so many yards of bell wire were taken as a unit of resistance and the voltage of dynamos was gauged by the brilliancy of lamps, electrical knowledge was certainly not profuse; but it must not be imagined that because modern knowledge and improvements have made these crude methods appear ridiculous, our existing ideas will always escape criticism. Our modern power stations, with their large high-speed turbines and all the other paraphernalia, will in all probability appear to future electrical engineers just as odd as the earliest stations appear to us, and just as we sometimes wonder why the pioneer workers did such extraordinary things, so will those who follow us marvel at our stupidity.

Commemoration meetings are, of course, essentially concerned with the past and not with the future; but in summing up the proceedings Mr. Ll. B. Atkinson referred to a matter which seems to be creating a fair amount of interest at the present time. "It is well," he said, "that on this fiftieth anniversary of the first meeting of our Institution, we, and especially the present generation of electrical engineers, should collect and visualise a picture of the past, because we may be, and I believe we are, at the beginning of another age, a tremendous era, when the atom and its energy will probably replace all those generating appliances we have been looking at." How much importance should be attached to this prophecy we must leave our readers to decide. It may be a long time yet before there are any important practical developments in the direction which Mr. Atkinson indicated, but in any case it is abundantly evident that the present method of producing electricity falls a long way short of perfection, and it will be strange indeed if a better method is not ultimately discovered.

Chinese Engineering Notes.

(From our own Correspondents.)

Peking.

THE political troubles here reached a climax on April 29th, when the rival forces of Generals Chang Tso Lin—known as the Mukden War Lord—and Wu Pei Fu clashed some fifteen miles south of Peking and at Machang on the Tientsin-Pukow Railway. There was considerable fighting for five days, in which it is estimated that nearly 100,000 troops were engaged. Everything appeared to be going in favour of Chang Tso Lin's forces until the night of May 3rd, when they utterly collapsed on all fronts, and at the time of writing are in full retreat towards Tientsin *en route* for Mukden. No fighting actually took place in the city of Peking, as the authorities took precautionary measures by closing all the gates. These are still closed, and it is not possible for anyone to leave the city. No trains have been running on the Peking-Tientsin line for three days, and everything is completely disorganised. Business in Tientsin is completely at a standstill owing to the fear of looting by the retreating armies. So far as one can gather, the retreat has been carried out in a comparatively orderly manner, and General Chang's forces appear to have saved most of their guns, ammunition and equipment.

It is quite impossible to foretell the effect of General Wu Pei Fu's victory. He is a man who has a very large following; he has proved himself to be an able administrator and a good soldier, but whether he is capable of forming a strong Government is doubtful, and this is the most important thing for China at the moment. It requires the hand of a very strong man to put Peking politics in order after this little affair. It is a curious thing that most of the reasonably strong men with knowledge of Chinese politics have been backing Chang Tso Lin. If General Wu Pei Fu could and would establish a military dictatorship for a time things might straighten themselves out. Whatever the final outcome is, this little war has cost a great deal of money, and the Government, whatever form it takes, will be in a very embarrassing position financially. Every cent of revenue from the Peking-Hankow and Peking-Suiyuan Railways has been taken by the military people during the past two months, and at the moment they have not sufficient money to pay salaries. The Peking-Hankow Railway is in debt to the extent of over 30,000,000 dols. (Chinese currency). The amount of money owing to the various Chinese Government railways by the Board of War is said to be well over 50,000,000 dols.

Negotiations are proceeding in Peking for the formation of a Sino-British Industrial Bank. On the Chinese side the necessary capital is available, and it is being subscribed by Chinese business men only. The inclusion of politicians in the past in these schemes of joint Chinese-foreign enterprises has proved a complete failure. It works very well so long as the particular political party is in power, but when it is not one might just as well be without Chinese partners. The Bank scheme is one that is needed very badly in China to assist the manufacturer to get orders. There are at the present time seven Sino-foreign Industrial Banks operating in China, including Italian, French, Belgian, Japanese, American and Scandinavian, but no British. A special Charter is being obtained from the Chinese Government, and British manufacturers will be invited to subscribe to the capital. It is proposed to have a highly organised Industrial Intelligence Department in connection with the Bank where British manufacturers will be in a position to obtain the latest and most reliable news of forthcoming enterprises. Less than £200,000 are required from the British side to start this Industrial Bank, and those manufacturers who are looking to China for orders would do well to consider the scheme.

Those of us interested in British trade in China are always pleased to hear of practical schemes being suggested by others having the same object in view. Documents relating to the formation of "The Sino-British Trade Association" have been received in China, but the scheme as set forth does not so far meet with much enthusiasm. It is said that the objects of the Association are "To assist in England Chinese-owned business houses carrying on business in any part of the Republic of China, the British Crown Colonies of Hong Kong and the Straits Settlements and the Federated Malay States. To introduce Chinese merchants to British buyers, and generally to promote trade between Great Britain and the Republic of China" by attention to legislation, by the establishment of trade reference libraries, by the holding of exhibitions, and so on. It will also, I gather, act as a financial house.

Conversazione of the Institution of Civil Engineers.

ON Tuesday last the Institution of Civil Engineers held a conversazione in its home in Great George-street, Westminster. The very large gathering of members and guests were received by the President—Mr. W. B. Worthington—and Mrs. Worthington in the Grand Hall.

In addition to an extensive musical programme provided by a band of the Royal Artillery—in the Entrance Hall—and Madame Edna Thornton and the Gresham Singers—in the Lecture Theatre—there was an exhibition in the Library of interesting scientific objects and apparatus. The different departments of the National Physical Laboratory were well to the fore. There were the thermal conductivity apparatus of Drs. Kaye and Griffiths; a demonstration of fluorescence under ultra-violet rays by the same investigators; an electrically driven gyroscope; photo-micrographs illustrating the micro-structures of light alloys; a tilting level comparator; a crossed-coil radio-telegraphic direction-finding apparatus for both damped and continuous waves; an apparatus for showing the spontaneous generation of heat in quenched aluminium-zinc alloys; and a large collection of light alloys of different composition and both cast and wrought. The exhibit of Sir Robert Hadfield, F.R.S., contained many familiar objects, among which were examples of British, French and German shrapnel helmets, and a body shield, as evidence of the relatively high efficiency of manganese steel as compared with other steels in bullet stopping; cabinets of test and other specimens of steel; sets of bottles containing the various constituents of steels; a collection of books and other objects of historical interest in connection with steel; the original transformer made, in 1903, of low-hysteresis steel; machines for testing the hardness and toughness of steels; and a Guillery shock-testing machine. Mr. W. M. Mordey gave a demonstration of his ingenious repulsion apparatus by which he successfully separates magnetic from non-magnetic materials, and to which we referred in connection with the recent conversazione of the Royal Society. Dr. E. H. Rayner exhibited and showed in operation his Rotascope, an apparatus by which "a rotating object may be rendered continuously visible and yet appear to be at rest." Professor S. M. Dixon had on view a camera specially designed for surveying work, and an excellently executed map made with it. The Cambridge and Paul Instrument Company, Limited, showed examples of the clever Collins micro-indicator for high-speed engines—which was also at the Royal Society's *soirée*—and of a combined carbon dioxide and flue temperature indicator. A model of the sluice of the Aswan dam used in calibrating the discharge through the dam sluices was shown by Dr. H. E. Hurst and Mr. D. A. F. Watt. The apparatus for demonstrating the action of planing and milling tools which Professor E. G. Coker showed on behalf of the Cutting Tools Research Committee of the Institution of Mechanical Engineers attracted a considerable amount of attention. It was the same apparatus which was recently exhibited in Paris.

Among the other exhibits which we saw were an apparatus for demonstrating aerofoil characteristics, shown by Mr. P. V. Hoare; a pneumatic drill for

making holes in steel up to 1in. in diameter, shown by Mr. S. E. Thornton; a model train consisting of locomotive and carriages, made about the year 1848, shown by Mr. Robert H. Read; and a surveyor's level and an example of the Fereday-Palmer stress recorder, shown by T. Cooke and Sons, Limited. There was also a demonstration by Dr. J. S. Owens of the methods he uses in obtaining records of dust particles from the air. Finally, though it was by no means the least interesting of the exhibits, the "Schoop" pistol was shown in operation by Mr. J. L. Hodgson. This ingenious apparatus is not new, having been invented by a native of Zürich some time before the war, but because of the latter it has not hitherto come into much prominence. It is, virtually, a special form of blow-pipe in which a mixture of inflammable gases, such as oxygen and hydrogen, or oxygen and acetylene or coal gas, is fed through an annular opening, the greatest diameter of which is less than ¼in., and the width possibly $^{1}/_{64}$in. Air under pressure is supplied through a series of holes arranged in a circle round the annular gas opening, but quite separate from it, and, finally, a thin wire of the metal or alloy to be used for coating purposes is pushed by means of a turbine, driven by the compressed air, through a hole arranged centrally both with regard to the annular space and to the series of air holes. The wire fuses and is pulverised or broken up into an exceedingly fine spray or mist, which is projected on to the surface which it is desired to coat. In another form of the pistol the material to be sprayed is used in the form of powder. Any metal or alloy can be sprayed, and the coating, which will take a fine polish, can be of any desired thickness. Any surface, whether of metal, stone, brick, concrete, glass, fibre, plaster, rubber, vulcanite, wood, compressed sawdust, pasteboard, paper, papier mâché, celluloid, can be metal-sprayed, and metal objects can be reproduced from moulds.

During the evening there was an exhibition by Lieut.-Colonel Sir Francis Younghusband, K.C.S.I., K.C.I.E., of some beautiful photographs of Mount Everest. Captain Riall Sankey, C.B., with the aid of a large display of instruments, gave a lecture with demonstrations on "Broadcasting," and there were also wireless demonstrations in another room. For those who took the trouble to go and see it, the Institution's museum, which contains a collection of specimens illustrating the deterioration of structures exposed to sea-action, was open for the occasion.

The Incorporated Municipal Electrical Association.

THE annual conventions of the Incorporated Municipal Electrical Association are acquiring added importance year by year, and that fact was emphasised at the twenty-seventh convention, which took place at Wolverhampton, Stoke-on-Trent, and Birmingham during the week June 19th to 23rd. The President this year is Mr. S. T. Allen, the chief electrical engineer to the Wolverhampton Corporation. The papers were but little concerned with matters of outstanding technical importance. Only three were read, and two of them dealt with administration and sales and only one with pure engineering, but useful work affecting the relations between British manufacturing interests and the municipalities which place orders for large machinery was done. The fact is that in spite of all that is being said as to the effect upon British industry of the depreciated continental exchange, we are yet able to quote competitive prices in this country, and particularly in the electrical industry, which appears to be the most prosperous of our trades at the moment. That fact was demonstrated during a visit to the extensive works of the General Electric Company, at Witton, where orders are in hand for all parts of the world. Notwithstanding the lock-out, during which time the works were to all intents and purposes closed, with the exception of some work of a special nature done by the staff and apprentices, they are now in full swing again. It would be idle to deny that the thoughts of manufacturers still turn to the pre-war days, when orders for large electricity generating sets went to the Continent with disconcerting frequency, solely on the question of price, it being admitted that on technical grounds the continental machines could give no points to British machines. In those days British manufacturers did not appear to be in such close harmony with the home market; but things have changed, and now we find a desire on the part of the municipal electrical engineers to go a long way to ensure that the British electrical manufacturing industry shall be supported in a manner which will make it a prosperous one. On the other hand, the British manufacturers are fully alive to the fact that the best of sentiments must give way to commercial considerations, and that price is, and must remain, the dominating factor, assuming parity of quality and performance.

Another aspect of the convention, as distinct from the purely formal business transacted, was the prominence given to the unfortunate results likely to attend any idea on the part of municipal councillors that power companies are their natural enemies. It has been truly said that there is no room for competition in the electrical industry, and that the large municipalities—and the small ones, too, of course—must work harmoniously with the power companies which operate on their borders. This parochial antagonism is still found in parts, but must not be laid to the charge of electrical engineers, who in many instances display a breadth of view which their councils could, with advantage, imitate. The policy of co-operation between power companies and municipalities, however, is making headway, and it is worth noticing that many men prominent in municipal electrical circles as engineers years ago, and who have left to enter company employ or to act as consulting engineers, never lose the opportunity at the I.M.E.A. conventions, to which they are annually invited, to preach this doctrine. This is all to the good, and helps to bring those who are wholely engrossed in municipal work out of a possible rut and give them some idea of what is going on around them. In these directions, therefore, the I.M.E.A. conventions serve a purpose which a few years ago would have been regarded as impossible. Moreover, the Association is now working in the closest touch with the manufacturing interests through their trade associations, and has representatives on joint committees which are doing good work in matters relating to standardisation and design, work which makes it all the easier for the two branches of the industry to discuss other matters, not the least important of which is prices. The need for the extension of this spirit of co-operation in every possible direction within the industry was the theme of the presidential address by Mr. Allen, who, almost for the first time in such an address, or indeed before the Association at all, drew attention to the influence upon our export trade of development and progress in the electricity supply industry at home.

There is not a great deal that need be said of the first two papers. One was by Lieut.-Colonel W. A. Vignoles, D.S.O., chief electrical engineer at Grimsby—who is the new President—and dealt with the best means for extending the domestic uses of electricity. His conclusion is that this load could rise to enormous dimensions if properly encouraged. A great deal is expected from a heating and cooking load in the neighbourhood of 1½d. per unit, but criticism of electric cooking apparatus is by no means yet silenced, and although the I.M.E.A. and the British Electrical Development Association have a joint committee at work on standardisation and improvement of designs, there appear to be still some objections which are holding back that development which the enthusiasts have been looking for during the past few years. There has been, nevertheless, a considerable increase in the amount of power supplied for cooking and heating purposes, and it has been well said that we cannot wait for the perfect apparatus. Such a policy would mean never making a start at all. Probably the best suggestion made for a long time is that a number of supply authorities should join together and buy apparatus in bulk, and so assist the manufacturers to reduce price and turn out a reliable commercial article on standard lines. The Grimsby Corporation has authorised an expenditure of £500 for this purpose, and the suggestion is that a number of other supply authorities should take a similar action and all pool their capital and take the matter up with the manufacturers.

The second paper, read at Stoke-on-Trent, was by Mr. E. Calvert, chief electrical engineer at Finchley, and dealt with a problem in the administration of municipal electrical undertakings which has been causing some perturbation for a long time. It is the alleged encroachment of borough accountants and treasurers upon the domain of the municipal electrical engineer in regard to the financial management of their undertakings. The matter, however, is one upon which there is considerable difference of opinion, and the obvious way out of the difficulty is co-operation, which seems to be practised in many parts of the country.

The third and final paper was by Mr. R. A. Chattock, chief electrical engineer at Birmingham, who gave a comprehensive review of the various apparatus available for sub-station equipment. It raised again the question of direct current *versus* alternating current supply, the consensus of opinion being that alternating current offers the cheapest method of dealing with the supply. The cost of direct-current sub-station equipment, on the figures given in the paper, is distinctly greater than where simple static transformers are used, and many engineers who have been saddled with a direct-current distributing system in the centres of their towns, through their undertakings having been started many years ago, would admittedly not adopt that system now if they were starting afresh. Glasgow is a particular case in point, and although Mr. Chattock adhered to his view that the direct-current system offers a more reliable method for dealing with the centre of a town like Birmingham, where an interruption to the supply might easily be disastrous, it is not at all certain that he would adopt this system had he not to deal with an already established plant. Among the sub-station equipment at Birmingham is a 235-kilowatt mercury arc rectifier, at the Harborne sub-station, supplying 440-volt direct current from 5000-volt alternating current, three-phase, 25 cycles, and running in parallel with rotary converters and storage battery across the outers of the three-wire lighting and power distributing network. It has been proved that for a 1500-volt direct-current supply this type of apparatus is more efficient than any type of rotary apparatus, and if the pressure is increased to 3000 volts, the difference is still more marked. The rectifier at Birmingham has only one cylinder, and has given every satisfaction, but certain troubles have been experienced with a 1500-kilowatt rectifier with three cylinders, dealing with 500 kilowatts each, at Glasgow.

Some interesting points are given in the paper as to the construction of battery rooms. In the early days it was found difficult at Birmingham to provide and maintain an acid-proof floor. Asphalt was tried, but it became soft, and was not impervious to acid. Ultimately, a floor was developed, constructed of ½in. of asphalt, laid on concrete, with a 2½in. hard-pressed blue brick tile, placed ½in. apart and run in with hot pitch, laid on top. It was found to be quite impervious to any acid. Again, in roof construction acid-resisting paints have been found unsuitable for protecting ordinary steel construction. Even five coats of best red lead and boiled oil are not absolutely impervious, and the best construction is a flat concrete roof with the joist work in the concrete, so that there is no exposed metal to be attacked. Again, in order to prevent annoyance to surrounding property from acid fumes from the battery room when charging, it has been found necessary to provide acid neutralisers, which wash the air before it is discharged to the outside. They consist of screens of finely perforated lead plates, over which water is allowed to trickle, and through which the air is drawn. A screen consisting of ten sheets of perforated lead plate is quite sufficient to wash all the acid out of the air.

Among the matters discussed at the annual general meeting on Friday, June 23rd, was the question of the manner in which the expenses of the Electricity Commissioners should be met. Under the Electricity Supply Act of 1919, the expenses of the Commissioners are apportioned among the supply undertakings of the country. Few Government Departments have met with such general approbation of any industry as have the Electricity Commissioners, and the manner in which this small body of experts is handling the industry is a fine testimony to the wisdom of having departed from the old Government policy of appointing Civil Servants to such posts. It is now possible to go to the Commissioners in the full knowledge that they will thoroughly appreciate both the technical and administrative points of the industry, and deal with them broad-mindedly and with the complete absence of red tape. It was the appreciation of this fact which led the meeting to turn down a proposition that endeavours should be made to transfer the expenses of the Commissioners from the industry to the National Exchequer. Things are going so smoothly as between the Commissioners and the industry that the fear of a more or less uninstructed control by the Treasury, should the expenses of the Commissioners be made a national charge, is sufficient to induce the majority of those representing at any rate the municipal electricity supply industry to prefer to pay their share directly of the Commissioners' expenses. The suggestion for the alteration came from Edinburgh, it being stated that Scotland feels very strongly that these expenses should be a national charge.

Another matter raised was the desirability of supply authorities being able to enforce the Institution of Electrical Engineers' Wiring Rules upon wiring contractors. At present, although a supply authority may adopt the wiring rules, they cannot compel wiring contractors to carry out their work according to them, and the Electricity Commissioners are to be asked to assist in the matter in some way.

Books of Reference.

IT would appear that, on and off, for the last twenty-nine years we have expressed our appreciation of Kempe's Year Book. Sometimes we wish that just for one year it would cease to come out, and excuse us from the annual task of trying to say the same thing in a different way. For, after all is said and done, one can only keep on repeating that amongst engineers' books of reference, Kempe is indispensable, and if one has any regret at all about it, it is that the volume is getting so uncommonly portly that fission must sooner or later take place between the parts. It first appeared as a modest volume which one might almost slip into the pocket, in 1894. The 1922, or twenty-ninth edition, which is published by Crosby Lockwood, price 30s. net, measures from cover to cover 3½in., and contains in all 2735 pages! We do not like reviewing books by "bulk," but in the case of an annual volume of reference, size is in some degree an indication of real progress as well as of mere growth. At the same time, we may point out that at least a score of the articles have been wholly rewritten or enlarged for the present edition, and it is pleasant to note that in all cases the editors have been fortunate enough to secure the collaboration of recognised authorities. Amongst the principal changes, we notice that the article on autogenous welding has been entirely rewritten. Professor D. Richardson is the author, and we may congratulate him on the skill with which he has covered the principal points and eluded debatable topics. It is the knowledge that "Kempe" is always up to date that makes it the most valuable book of reference on the engineers' shelves. We can pay it no higher compliment than to say that it has taken the place that was once held by D. K. Clark's big volume of "Rules and Memoranda."

Literature.

Steam Turbines. By W. J. GOUDIE, D.Sc. London: Longmans, Green and Co. 1922. 30s. net.

IT is still less than twenty years ago that the lot of the advocate of the steam turbine, if not an unhappy one, was at least an uphill one. The enthusiast who was fortunate enough to be associated with the rotary engine in its early days was far too absorbed in the interesting and manifold problems which surrounded the whole subject in every direction to be depressed by the adverse criticism which greeted the new motor, or to waste time and thought over the often very pessimistic prophecies regarding its future. Confidence in the steam turbine was, with few exceptions, still lacking as late perhaps as 1905–6, even though it was about then that the enormously rapid world-wide development of the system began in earnest. The history of the early struggle for success between about 1885 and 1900 has never been properly recorded—it is known to very few—but even after the first 1000-kilowatt steam turbine set had been put to work in the latter year, there was for long enough a very distinct reluctance in practically every country to accept the turbine system gladly. It is interesting nowadays to look back upon this era, and to seek some reason why, instead of welcoming a new invention, which in spite of its faults certainly offered promise of remarkable development, engineers distinctly hesitated for a lengthy period before they were, often against their will, convinced of its merits. One reason was distrust of its high speed, but the most cogent one was undoubtedly the general lack of information of any kind regarding the very nature of the design. It may be said that psychologically, the Parsons turbine most certainly took the engineering world by surprise, and particularly marine engineers, for the land development abroad became considerable soon after the first 1000-kilowatt turbine was installed at Elberfeld. In both directions, land and marine, performance far anticipated all published theory, and the conservatively inclined, however willing to investigate the new motor, sought in vain amongst all the text-books of the world for any indications as to how to undertake the design. It is no exaggeration to record that to the growing circle of those who began to be interested in turbine development about 1900–01, when wide attention was drawn to it through the performance of the ss. King Edward on the Clyde, one of the most interesting aspects was the fact that practically nothing could be learnt about the subject from books. To produce a new design it was necessary to work from basic knowledge. No text or pocket-book replete with empirical data existed to guide the would-be designer on to the paths through the science of turbo-mechanics. Whatever claims were made by enthusiasts barely two decades ago on behalf of the steam turbine as regards its intrinsic merits, not a single one ever anticipated the really remarkable advance in knowledge, both of engineering and thermo-dynamics, which its development has entailed.

In a volume containing 800 pages and embodying some 330 plates and diagrams, Dr. W. J. Goudie, late of University College, London, and now James Watt Professor of the Theory and Practice of Heat Engines at Glasgow University, has produced a treatise on steam turbine engineering which bears emphatic testimony to an aspect of the results of the introduction of the steam turbine which has hitherto been insufficiently recognised. So rapid has been the development, that for many years past it has been a difficult and somewhat unsatisfactory matter to produce a good text-book on turbine machinery unless the repeated publication of further editions was to be faced, but there is no doubt whatever that Dr. Goudie has succeeded in placing before his readers information regarding turbine design in a form that must render his book a standard work of reference on the subject for many years to come. Dr. Goudie's work is entitled "Steam Turbines," and it deals with them only. He has avoided reference to correlated subjects, such as generators, condensing plant or propellers, all subjects needing particular treatment on their own account, and has steered clear of elaborating the interesting but hardly scientific information relating to the historical development of different types. The theory and design of the three or four types of steam turbine which are now almost universally adopted are subjects involving the treatment of a very wide number of problems, and it is very interesting in scanning the pages of Dr. Goudie's book to realise how those enforced on designers by the recent trend of turbine practice have been so thoroughly considered. Several years have elapsed since the publication of Dr. Morrow's excellent work on turbine design, and quite a number of new conditions have consequently been set up, both in land and marine practice. In the former, the consistent increase in speed of rotation for a given output has introduced fresh problems in rotor design; in both, and particularly in marine work, the use of gearing has enforced wide departures from previous practice.

Dr. Goudie's arrangement of chapters is certainly excellent. The first five, containing some seventy odd illustrations of modern machines, are devoted to descriptions of the various types of turbine now being installed. Two more deal with the properties of steam and energy diagrams, and another with the design of nozzles. Very good chapters on the design of blading, on rotor design, and on mechanical reduction gear precede others dealing with the losses and the calculation of efficiency and steam consumption. Three chapters are then devoted to the determination of the general proportions of steam turbines of various types, numerous examples being worked out in detail. These chapters contain some excellent information for the use of all engaged on design work. The concluding chapter deals with the governing of various types of turbine.

The descriptive matter in the early portion of the book calls for little comment. Attention has been paid to all prominent types, large or small, though a plate showing an external view of the Parsons 10,000-kilowatt tandem turbines at Carville Station, which so far hold the record for low steam consumption, would have been a welcome addition as an instance of the development of this type. The thermodynamic section contains much that is of interest and value. There is a chart of the specific heat of superheated steam based on Callendar's tables, which, if compared with charts based on certain other researches, will be found to indicate slightly lower values than those in previous use, and at a time when the question of the variation of the specific heat of gases with pressure as well as temperature is attracting so much attention, the variations for H_2O are significant. The use of nomograms or alignment charts for the calculation of total heat and specific volume of superheated and supersaturated steam is both a striking and a useful innovation, in that these diagrams solve the Callendar equations and are very readily legible for their required purposes. It is obvious that a considerable amount of laborious work has been put into their construction. The section on nozzle design does not add very much to existing information on the subject though the matter is fully and ably treated, for the reason that knowledge of the question of nozzle efficiency is still very incomplete. It is a difficult and abstruse subject, and we are reminded that the work of the Research Committee on Nozzles, appointed by the Institution of Mechanical Engineers, is as yet incomplete and not available for publication. In dealing with blading, the reasons for the superiority of the stage efficiency of the reaction type over that of the impulse type are very clearly explained, and some useful information is given on the values of the ratio of blade speed to steam speed for the various types of machine, such as the single impulse, the velocity compounded, and the reaction type. We have yet to see published simultaneously sufficiently detailed information of the results of consumption tests, measurements of pressure and temperature along the turbine, and full data of blade or nozzle openings for comparative types, in order to enable precise values for a given case or cases to be calculated. And yet there is a mass of data in existence on the subject! The various efficiencies for two-row, three-row and four-row velocity compounded wheels, from the point of view of diagram efficiency only, have been worked out, and as these ratios are very important, the following statement has been extracted:—For a normal inlet angle of 20 deg., the ratios of blade speed to steam speed to give maximum diagram efficiency for different types of turbine are as follows:—

Single impulse		$\frac{V_t}{V_s} = 0.47$
Velocity compound	2 rows of moving blades	$= 0.235$
	3 rows of moving blades	$= 0.156$
	4 rows of moving blades	$= 0.117$
Reaction		$= 0.94$

The values used in practice have hitherto been distinctly less than the above, and for reaction turbines in particular a value exceeding 0.8 is very rare, even in the best land practice. The fact that the turbine must be designed for wide variation of load, coupled with the necessity of restricting dimensions to no small extent on account of the commercial considerations of size and first cost, tends to keep this ratio well below the maximum.

In discussing blading design and turbine proportions, Dr. Goudie has pursued a most useful course. The theory and construction of the velocity diagrams for various types is given in great detail in one part of the volume, and in a later section he has worked out in full numerous examples of the methods of calculation more generally employed for both impulse and reaction turbines. One is inclined to challenge his statement that the problem of design of an axial flow reaction turbine is less determinate than that of an impulse, that it involves a considerable amount of assumption regarding design coefficients, and also trial and error calculation, and that it is therefore more difficult to formulate definite rules of procedure. This is very far from being the case in practice, particularly in marine work, in which the blading must necessarily be in the nature of a compromise, owing to the varying blade speeds at which the turbine must work as the speed of the vessel alters. Dr. Goudie has given a very clear exposition of the derivation of the coefficient for calculating the number of rows of blades in a reaction turbine. This coefficient is so widely used among turbine designers as the symbol K that its introduction as λ seems quite unnecessary, and a table giving typical values of K for various machines, together with total heat drop and thermal efficiency ratio obtained, should find a place in any standard volume on turbine design. Once it has been clearly established that the basis on which the coefficient is founded is correct—and Dr. Goudie himself proves this—then the coefficient method will be found far simpler and more easy to handle than a more elaborate method of calculation which, after all, will eventually only lead to a practically identical result. There is another point in these calculations in which Dr. Goudie is apt to mislead students. He states that experience during the past few years has shown that, provided the wheels are made proportionately heavier and sufficiently stiff, mean blade speeds as high as 800ft. per second may be used. Now, a great deal of trouble has been experienced with speeds exceeding 700ft., and there has been a very distinct check to retaining these velocities in consequence. Standard British practice in this respect is now restricted to under 600ft., as it has been found that to secure adequate rigidity and strength for higher velocities, the wheels required to be made disproportionately heavy and costly. On one very necessary refinement in design Dr. Goudie has not touched; that is, on the design of cylinders as regards their economic rating. It is, in fact, rather surprising that although the question of rotor design is very fully dealt with, that of cylinders receives much less or rather hardly any treatment at all. If separate designs were got out for each machine built, knowledge of merely how to calculate the blading proportions would go a very long way; but for purposes of economy of manufacture, the same cylinders, and particularly their exhaust ends, have to be utilised for widely varying conditions of power output and vacua, and blading must be calculated and the cylinders designed originally with this end in view.

There is a mass of valuable information contained in the book, and in perusing its pages one discovers numerous references to points which were keenly debated many years ago, and which are now dealt with with the pen of authority. It is very satisfactory that the Callendar tables are now presented in readily usable form. Mr. H. M. Martin's able investigations of gland and dummy piston leakage have been embodied in an alignment chart, which enormously simplifies the labour of calculating the losses from these sources. The section on critical speeds of rotors has been extended to cover the case of multiple bearings. The sample calculations for dimensions of reduction gearing are of special interest at the present time. None of this information was previously available in such condensed and applicable form. Dr. Goudie has avoided touching on a number of points which would only have served to swell the volume without adding much to the main theme, and which really require entirely separate explanation. The book is essentially a presentation of the Callendar data for purposes of design, coupled with an elaborate theoretical and practical demonstration as to why and how it should be applied. The principal omission in the volume is common to nearly all treatises on the steam turbine. There are very few actual figures given for steam consumptions under different conditions, and none at all for machines of given proportions. When the scarcity of the published data on this subject is contrasted with that available for boiler plants or for reciprocating engines or for other types of machinery, one is compelled to wonder how it is that in spite of the colossal horse-power of turbine machinery at work, more information regarding performance for given proportions is not available. One reason undoubtedly lies in the fact that the development has been so very rapid that both design and performance have been in a constant state of improvement year by year between, say, 1902 and 1914, and that perhaps since then there has been too much to think about in other directions. It does seem, however, a pity that such an excellent volume as Dr. Goudie has produced could not have been amplified to the small extent necessary to give to his assumed efficiencies and blade speed ratios actual corroborative data from the performance of well-known machines.

BOOKS RECEIVED.

Ministry of Public Works, Egypt: Annual Report for 1918–1919. Cairo: The Government Press. Price P.T. 20.

Collected Papers on Acoustics. By W. C. Sabine. London: Oxford University Press, Amen Corner, E.C. 4. Price 17s. net.

Aviation in Peace and War. By Sir F. H. Sykes, G.B.E., K.C.B., C.M.G. London: Edward Arnold, 41–43, Maddox-street, W. 1. Price 8s. 6d. net.

Alternating-current Electrical Engineering. By Philip Kemp. London: Macmillan and Co., Limited, St. Martin's-street, W.C. 2. Price 17s. net.

The Railway Year Book for 1922. London: The Railway Publishing Company, Limited, 33, Tothill-street, Westminster, S.W. 1. Price 5s. net.

Insulating Varnishes in Electrotechnics. A Text-book for the use of all electrical engineers and students. By Alfred R. Matthis. Manchester: John Heywood, Limited, 121, Deansgate. Price 7s. 6d. net.

Text-books of Physical Chemistry. Edited by Sir William Ramsay, K.C.B., F.R.S., and F. G. Donnan, C.B.E., F.R.S. *Metallography.* By C. H. Desch. London: Longmans, Green and Co., 39, Paternoster-row, E.C. 4. Price 16s. net.

CUPOLA FITTED WITH CHARGING MACHINE

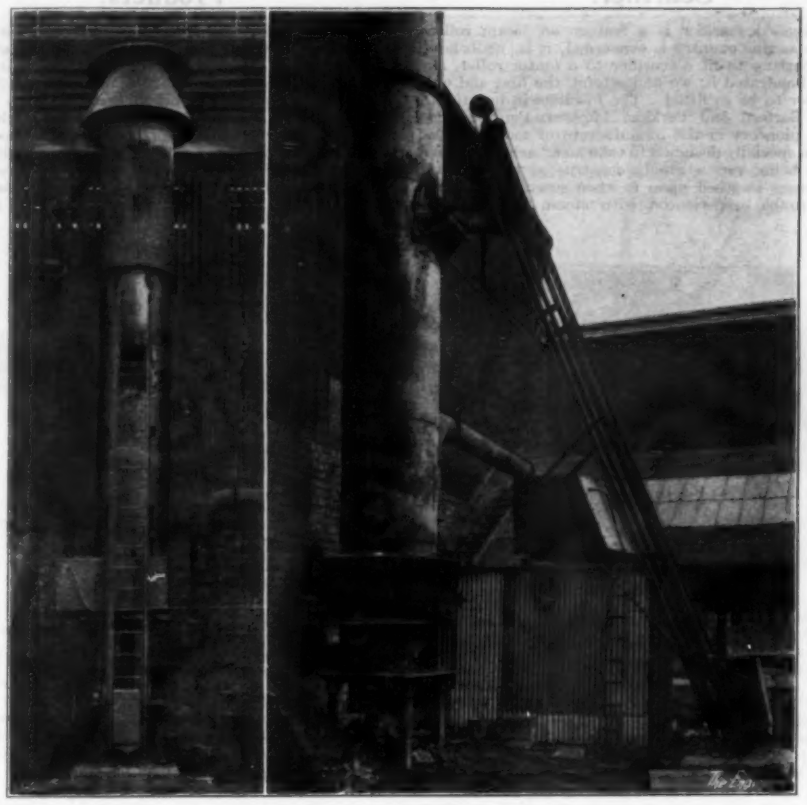


FIG. 1

Charging Machines for Cupolas.

In order to expedite the charging of cupolas as well as to avoid the expense of erecting a platform and hoist, a machine has been designed and constructed by Thwaites Brothers, Limited, Bradford, which possesses the advantages of simplicity and comparative low first cost, while necessitating no alteration in the construction of the cupola beyond a slight modification of the distributing plate. Fig. 1 shows front and side views of a motor-driven machine and cupola complete, and Fig. 4 represents a dwarf cupola with a hand-operated charging machine and fan. Fig. 5 is a drawing of the framework for a power-driven charging machine, showing the distributing plate in the cupola, Fig. 2 shows the arrangement of the power hoisting mechanism, and Fig. 3 the hoisting gear for the hand-operated machine. The framework of the machine is built up of rolled steel sections, and is provided with rungs to serve as a ladder to give access to the top of the frame. The buckets are built of steel plates welded together, with a cast steel base. The distributing plate is a substantial iron casting arranged for bolting to the shell of the cupola. An automatic knock-off gear is provided to prevent over-winding at the top of the framework.

The chief features of the hoisting gear are a continuously running shaft which obviates the use of a reversing motor and controller, while in the case of belt-driven machines only a single open belt is required. All the motions of the bucket are controlled by one lever, and the return of the bucket is effected by gravity under the control of a brake operated by the hand control lever, while if the hand lever is released, the bucket is automatically brought to rest.

The power-operated hoisting gear—Fig. 2—is of the twin brake type, and operates in the following manner:—

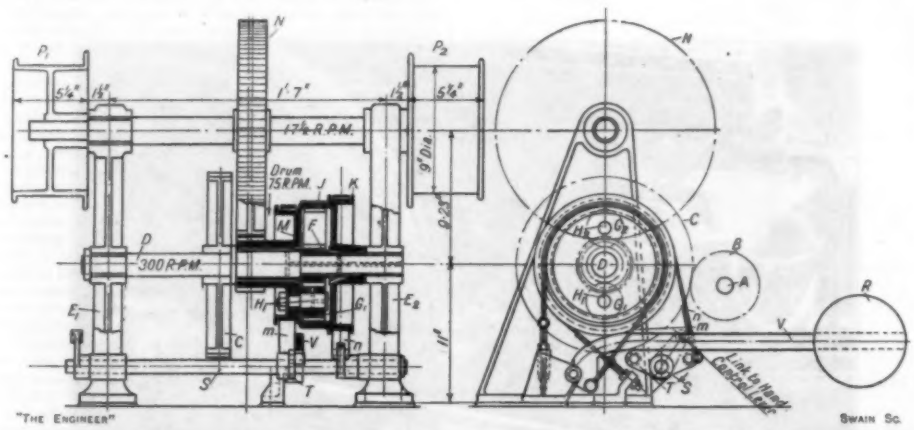


FIG. 2—ARRANGEMENT OF GEAR FOR POWER-DRIVEN HOISTING MECHANISM

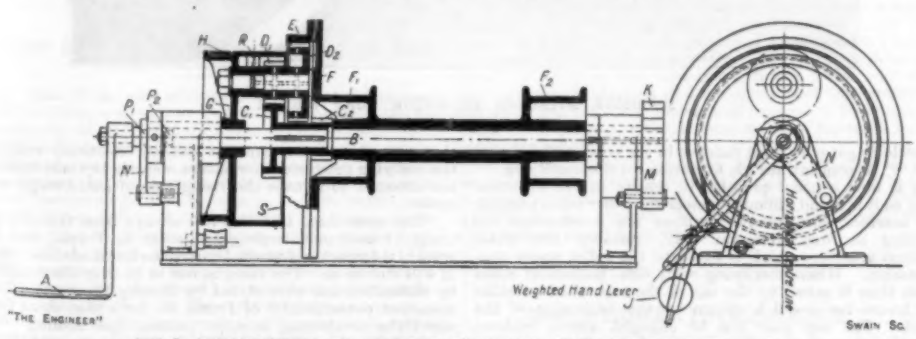


FIG. 3—ARRANGEMENT OF HOISTING GEAR FOR HAND-OPERATED MACHINE

The driving shaft A, which rotates continually in one direction, carries a pinion B gearing with a spur wheel C on the shaft D. To this shaft, which is carried in bearings on the two side frames E_1, E_2, is keyed a pinion F, which gears with one or more planet pinions G_1, G_2, which are carried on pins H_1, H_2, and gear in turn with the internal rack J, which carries a brake drum K. The pins H_1, H_2 are carried on a brake disc M, the boss of which is provided with teeth gearing with the spur wheel N fastened to the spindle, which carries the rope drums P_1, P_2. When the hand control lever is in the mid-position the brake-operating shaft S is in the position shown, and allows the weight R to apply a load to the brake on disc M by means of the brake band *m*. In this position the brake band *n* on the drum K is free, so that under these conditions the disc M is held firmly and the planets G_1, G_2 will rotate idly on their pins H_1, H_2, driving the internal rack J, which is free to rotate. Very little power is required

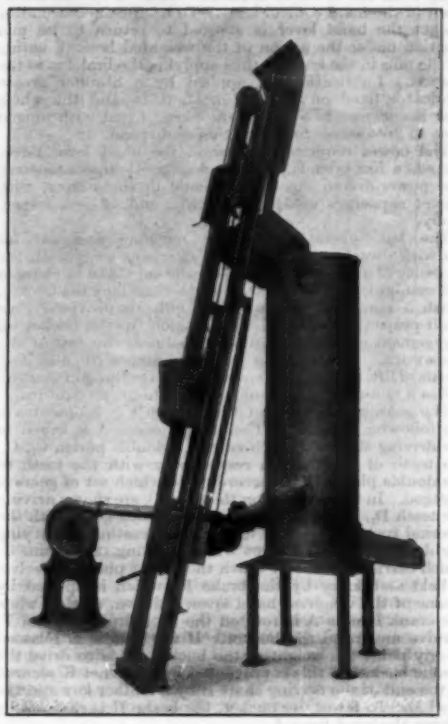


FIG. 4—CUPOLA WITH HAND-OPERATED CHARGING MACHINE

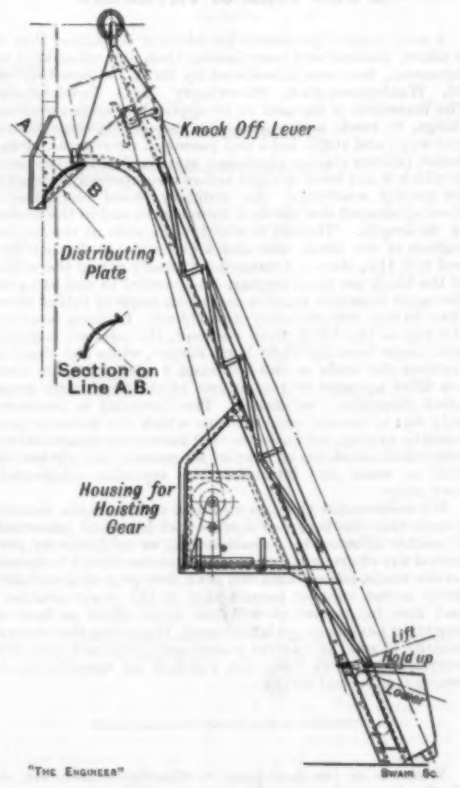


FIG. 5—FRAMEWORK FOR POWER-DRIVEN CHARGING MACHINE

to overcome the friction. In this position the brake *m* will sustain a loaded bucket or arrest it if it is descending.

To raise the bucket the hand control lever is raised, thereby rotating the shaft S in the direction of the arrow, and applying a load to the brake strap *n*. The shaft S carries a double-armed lever T to the ends of which are fixed two pins so that when the shaft S is rotated out of its central position in either direction the brake lever V is raised, thereby releasing the brake on the disc M. The upward movement of the hand control lever therefore applies the brake *n* to the drum K and simultaneously

releases the brake *m* on the disc M. The internal rack J is thus held, and the planets G_1, G_2 rotate around the centre pinion F driving the disc M, which in turn drives the rope drums P_1, P_2 through the spur wheel N.

To lower the bucket the hand control lever is depressed, thus rotating the control shaft S in the opposite direction to that shown by the arrow in Fig. 2, thereby raising the weighted lever V, which releases the brake *m* on the disc M and allows the bucket to return by gravity. The brake strap *n* on the drum K is further released by this movement of the hand control lever. To retard the descending bucket the hand lever is allowed to return to its mid position under the action of the weighted lever V acting on the pins in the lever T, thus applying the brake *m* to the disc M. Lubrication is supplied by a Stauffer grease lubricator fixed on the end of shaft D, and the whole gear is enclosed in a sheet iron casing fitted with hinged flaps to give access for inspection and repair.

The power required to operate the hand lever never exceeds a few pounds, and the response is instantaneous. The power-driven machine is made in three sizes, with bucket capacities of 3½ cwt., 7 cwt., and 16 cwt. respectively.

The hand-operated charging machine designed for use with dwarf cupolas or cupolettes does away with the necessity of a staging, and enables the cupola to be charged and manipulated by one man. In this machine the bucket, which is mounted on two wheels only, is provided with small projections on either side, which tip the bucket on engagement with a series of pins fixed near the top of the framework. The hoisting gear is designed to give two speeds of lift, one for coke and the other for the iron charges. It has a non-reversing crank handle and gravity return.

The gear, which is shown in section in Fig. 3, operates in the following manner :—The crank handle A is keyed to the driving shaft B, which carries a double pinion C_1, C_2, the teeth of which mesh respectively with the teeth of the double planet D_1, D_2 according to which set of gears is engaged. In the illustration the teeth C_1 are shown driving the teeth D_1, which in turn drive D_2, which gears with the internal rack E attached to the drum casting F carrying the drums F_1, F_2. Except when lowering, the drum G, which carries the pin on which the planet pinions revolve, is held stationary by the brake H, which is applied by means of the weighted hand lever J shown, so that when the crank handle A is rotated the rope drums F_1 and F_2 revolve and raise the bucket. If the handle is released at any point the weight of the bucket tends to drive the handle back, but this is prevented by a ratchet K secured to the end of the driving shaft B by a feather key and the pawl M. To lower the bucket, the brake H is released by raising the hand lever J.

When it is desired to raise a charge of iron, the gear should be changed, and this is effected by raising the catch N from the recess P in the shaft, drawing the shaft bodily forward until the teeth C_2 are in gear with the teeth on D_2, and dropping the catch N into the recess P_2. The gearing is lubricated by means of a grease lubricator R on the drum G, and a steel plate S is fixed to the internal rack to retain the grease in the gear-box.

A NEW FORM OF PAVEMENT.

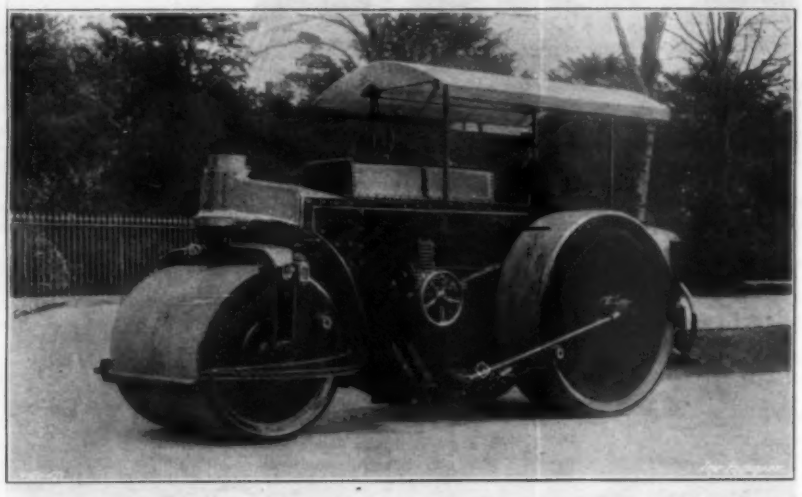
A NEW form of pavement for which it is claimed that it is silent, dustless and more lasting than any other kind of pavement, has been introduced by Mr. L. Wilton-Cox, of 12, Waldegrave-park, Strawberry Hill, Twickenham. The invention is claimed to be applicable, amongst other things, to roads and pavements, railway carriage floors, stairways and steps, halls and passages, courtyards, ships' decks, railway station platforms, and stables, but the form in which it has been brought before us is specially intended for paving roadways. An ordinary wood block has a dovetail-shaped slot cut in it from end to end in the centre of its length. The slot is about $^9/_{16}$in. wide at the top, or surface of the block, and about ⅜in. wide at the bottom, and it is 1¼in. deep. Arranged diagonally across the width of the block are three similar slots parallel to and at equal distances from one another and at an angle of rather more than 30 deg. with the ends of the block. Looking down on the top of the block from one end, the nearest diagonal slot starts from the right-hand corner, while the third or farthest slot ends at the left-hand corner. All the slots are filled up solid to the surface of the block with some black bituminous substance. The foregoing is, however, only one of several combinations which the inventor proposes to employ, for he states that he can use combinations into which steel, brass, copper, aluminium and rubber, as well as wood and bituminous or asphaltic compounds may enter.

We understand that, in addition to the claims set out above, that the inventor asserts that his wood pavement is neither affected by excessive heat or cold, nor by perpetual wet or drought ; that with it no sand need be spread on the roads, since horses can get a firm grip on it without, while motor vehicles cannot skid in the worst weather ; and that his pavement will last three times as long as any other pavement yet introduced. We gather that several lengths of road in various places are being laid with this pavement, but we have not yet had an opportunity of seeing it in actual service.

WRITING in the first issue of the *Roadmaker*, Mr. A. Dryland says that the chief enemy of the concrete road in America is, he thinks, the temperature extremes, which produce important movements in the subsoil, subjecting the slab to great stresses to which traffic stresses are a flea-bite. The evidence of this is to be seen in the cracks, mainly transverse but often longitudinal, which detract from the otherwise very fine appearance of these roads. It is, however, only fair to say that these cracks, if kept filled with tar or bitumen, do not appear to lead, under American conditions of traffic, to any serious deterioration, nor do they materially affect smoothness of travel, which is noticeably good compared with that over bituminous surfaces, which are prone to become sufficiently wavy to set up slight oscillation.

Motor Road Roller with Attached Scarifier.

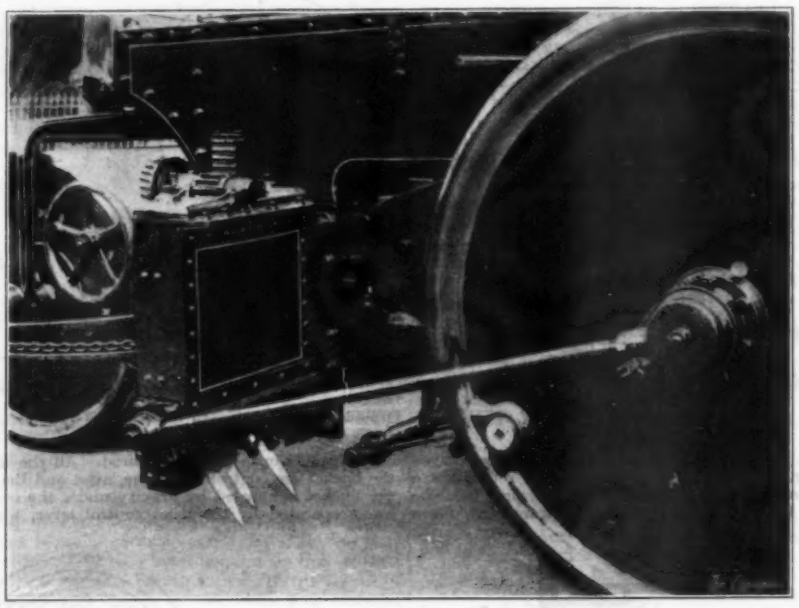
THE attached scarifier is a feature on steam rollers, but as far as this country is concerned, it is, we believe, a new departure to fit a scarifier to a motor roller, and the roller illustrated is, we understand, the first and only motor roller to be so fitted. The machine in question is made by Barford and Perkins, Limited, Peterborough, who were pioneers in the manufacture of motor rollers. It has been specially designed to take an attached scarifier, the frame being very strongly constructed to stand the severe stresses imposed upon it when scarifying. A not unusual trouble experienced with steam rollers is the straining of the boiler due to the pull of the scarifier, which may necessitate costly repairs and the laying up of the roller, possibly when it is most wanted. This source of trouble, of course, is entirely avoided in the case of a motor roller.



MOTOR ROAD ROLLER WITH ATTACHED SCARIFIER

For scarifying, it is essential to be able to exert the full engine power when travelling slowly. To ensure this condition in the present instance the roller is fitted with three speeds, the lowest speed of 1½ miles per hour being that used for scarifying. The makers claim that, as the variations in the load on the high-speed 30–40 brake horse-power internal combustion engine, with which this roller is fitted, are corrected by the governor, the driver is relieved of the duty of constantly manipulating the throttle to get over hard patches in the road, and is hence enabled to concentrate his attention on the scarifying.

It is now a usual practice to scarify in one direction only, as it is found difficult to steer the roller when pushing the scarifier, and many scarifiers are constructed for working in one direction only, notably the Price resilient scarifier, which is fitted to the roller under consideration. When scarifying with this particular roller much time is saved by the use of the top speed—4 miles per hour—for a quick return to the beginning of the patch. The top gear can be engaged direct, without changing through the other gears, and the whole operation is controlled by one lever only. A roller of this type, fitted with a three-tine scarifier, is, we understand, at present on a six months' demonstration tour in the North of England. It is a 10-ton machine. The makers inform us that an 8-ton model is also to be put on the market, and will be fitted with a two-tine Price scarifier.



SCARIFIER ATTACHED TO MOTOR ROAD ROLLER

The Persian Market for Engineering Products.

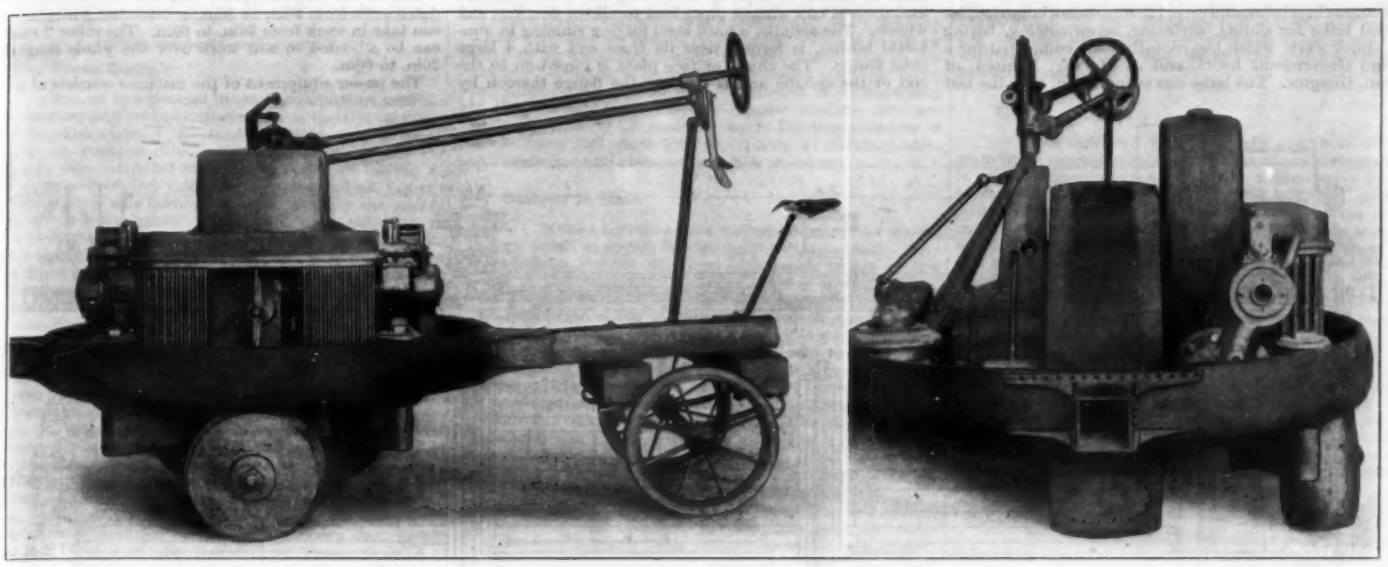
WE reprint below an extract from an interesting communication which has been received in the Department of Overseas Trade from the Commercial Secretary to his Majesty's Legation at Tehran, Major B. Temple, regarding the market for engineering products in Persia :—

"Than Persia, no civilised country in the world is more devoid of machinery and more pressingly in need of it ; yet no country in the world has so little present hope of procuring it. The very backwardness and poverty and political instability which require for their amelioration an active policy of industrialism based upon an extensive use of modern machinery, are the factors which impede industrialism and preclude machinery. Thus the backwardness is such that agriculture works with implements of the Biblical age and is too depressed and uninstructed to demand better. There are, however, some exceptions. Similarly, the arts and crafts are carried on with mediæval tools by manual powers and processes, and these also are too hidebound by herditary self-complacencies to seek betterment. There are, however, again some exceptions. The poverty is such that all agricultural and industrial activities subsist from hand to mouth, mostly borrowing the seeds or the raw materials with which to make each new start, and repaying the loan from harvested crops or from manufactured goods. The political instability is such that the central Government cannot effectively control the outlying provinces, nor assure security to trade routes, nor attempt to repress the rising tide of anti-foreign unreason.

"But something like this has always been the vicious circle of economic unprogressiveness in Persia, and in spite of it foreign commercial enterprise has made headway. It will still be so. The thing is, not to be over-discouraged by difficulties nor over-elated by illusory prospects. The economic potentialities of Persia are such that some day when the awakening is more general this country will surely become a hungry market for machinery, and those foreign manufacturers who have quietly studied the ground and prepared their plans and pressed their opportunities in the difficult times will have the best chance.

"Applying the foregoing general observations to the particular purposes of the British engineering manufacturer, the following further facts are to be noted :—Of

THE L'HERMITE AGRICULTURAL TRACTOR



engineering products the most obviously and urgently necessary are :—Agricultural machinery and implements ; bootmaking machinery ; electrical plant, machinery and accessories ; grain milling machinery ; hardware and metal smallware ; internal combustion engines ; iron and steel works plant and equipment ; mining, quarrying and metallurgical plant and machinery ; motor vehicles and road transport ; oil well plant and machinery ; paper-making plant and machinery ; pumps ; railway and tramway plant and material ; refrigerating and icemaking machinery and plant ; small arms and ammunitions ; textile machinery ; hand tools ; woodworking machinery ; wire. But the first and greatest of these needs, and indeed a pre-requisite to them all, is railway and tramway plant. This spacious country, as big as France and Germany combined, is landlocked by its own unrailed distances, and cannot move in any progressive direction until it be given the means of mobility. It will be understood that the introduction of engineering products in an ancient country which has only a dim and distant knowledge of the marvels of modern mechanics must be cautious at first and must deal gently with the ignorance and feebleness of the people. Machinery must be on the smallest scale, on the simplest plan, and of the cheapest standard, so that by modest and immediately successful beginnings the idea may become implanted in the Persian mind that a machine is not a consumer of money but a producer of money.

"My Persian mercantile friends impress upon me the following details :—What would sell soonest would be small power generating machines (to do the work of men who turn handles all day) ; small printing presses (flat, not rotary) ; small illuminating plant ; cigarette-making machines (I am told that more than three million cigarettes are smoked in Persia daily) ; small cotton spinning and wool spinning machines ; small cotton weaving and wool weaving machines ; and small pumps for irrigation. Power generating machines must be portable and capable of developing from 1 to 4 horse-power on kerosene oil ; construction must be simple and the parts must be strong and durable. Small electric plants for generating current for lighting purposes, charging accumulators should be capable of being run on kerosene oil and of maintaining from 50 to 250 lamps of 20 watts. The adjustment of the power to the load should be automatic. Printing presses may be actuated by hand, foot or motor, and should be able to take any size of paper from visiting card to foolscap size. Cigarette making machines must cut the roll of paper, cut the tobacco, roll the cigarette and fasten it. Thread making or spinning machines must be hand or foot driven for the family factory as well as motor driven for the public factory. Weaving machines are in great demand, especially for cloths 36in. to 42in. wide. These also should preferably be hand or foot driven at first. Power drive will come later. Agricultural machinery should be suitable for animal draught. Other immediate requirements are circular saws, lathes (hand driven), emery grinders, hand drills."

A New French Agricultural Tractor.

WE take from our esteemed French contemporary *Le Génie Civil*, a description of the single-wheel tractor designed by M. L'Hermite, which embodies principles entirely different from those generally used in motor vehicle construction. To give effective service, especially when working in small areas, it is essential for an agricultural tractor to be able to turn in its own length, and to be easily handled by a comparatively unskilled driver. The new tractor—illustrated above—has a single large driving wheel, which can turn in any direction. The wheel is supported in a horizontal circular frame, which frame also carries the draw-bar attachment for implements. The engine is of the valveless type, and of a novel design, forming along with the radiator tank, wheel supports and auxiliaries a complete unit. The whole of the tractive effort is transmitted by the single driving wheel, which not only enables a very robust design to be employed, but also does away with the differential, the speed-changing gear being built into the hub of the driving wheel. A diagrammatic plan of the tractor is shown in Fig. 1. In it, L is the draw-bar attachment, R the circular frame, M the motor, O and P the turning wheels, T the driving wheel, and N an auxiliary supporting wheel. The engine has two cylinders with opposed pistons, and both connecting-rods work on a single crank pin, which simplifies the crank shaft construction.

Fig. 2 shows the valve gear in section. A hollow shaft D is geared to the crank shaft, and runs at half the engine speed. This hollow cylinder communicates with the carburetter A at its centre. At one end it is provided with an oblique dividing wall, which, when the shaft is rotated, puts the cylinder ports alternatively in communication with the centre space of the tube F, from which the carburetted mixture is drawn, and with the other end of the tube D, which is open to the atmosphere and allows the exhaust stroke to take place. In order completely to cut off the cylinder from this chamber for the expansion and compression strokes, an annular sleeve B, which is furnished with piston rings, is fitted. This sleeve is made to slide by means of a cam G operated by cam rollers H. All the parts work easily without being effected by the heat or the pressure of the gases, a simple solution to the problems of gas-tightness and lubrication thus being obtained. The radiator elements consist of small vertical tubes, and the radiator is constructed in such a way that it may easily be dismantled. The assembled engine unit as will be observed is compact. It is built around one main casting, which carries the cheek through which the shaft carrying the main driving wheel runs. A small auxiliary wheel is fitted to assist in supporting the weight of the engine. The driving wheel is carried in roller bearings, and is geared in such a way as to give two forward speeds and one reverse. The clutch gear is not unlike that used in the ordinary motor car, and the gears are always in mesh when changing the speed. This is an advantage which will be appreciated by all tractor drivers. As already mentioned, the machine may be turned in any direction, by means of gears operated from the engine through clutches, which engage with an internal wheel attached to the supporting frame. The controls are very simply devised and arranged, and the operator can quite well drive the tractor and manœuvre it with one hand. The turning radius is very small, a figure of 1 m. being mentioned.

An interesting application of this new tractor is its use in connection with a balance plough of the type used in cable ploughing. In this case, the tractor is built centrally to the ploughs, the latter rocking about the same axis as the driving wheel.

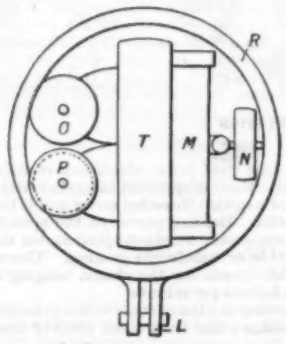


FIG. 1—PLAN OF TRACTOR

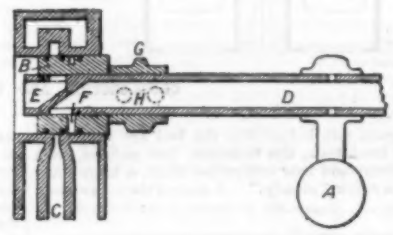


FIG. 2—SECTION OF VALVE GEAR OF TRACTOR ENGINE

EDUCATIONAL INTELLIGENCE.

THE Council of the University of Leeds has appointed Dr. W. T. David, M.A. (Cambridge), D.Sc. (Wales), to be Professor of Civil and Mechanical Engineering, and to take up his duties next October on Professor Goodman's retirement from the chair. Dr. David, who is at present Professor of Engineering at the University College of South Wales, was educated at University College, Cardiff, and Trinity College, Cambridge. He served as Demonstrator in Engineering under Professor Bertram Hopkinson at Cambridge for two years, and acted as assistant gas engine designer at Mather and Platts, Limited, for one year, after which he was appointed H.M. Inspector of Technical Colleges under the Board of Education. During the war he served as Inspector of Gun Ammunition Filling, being mentioned in dispatches and gazetted Major, General List, Inspection and Research Staff. He was afterwards appointed Director of Dilution of Munitions Labour, being subsequently transferred to the Admiralty to take charge of dilution in shipyards and marine engineering establishments. In his research work he has specialised on internal combustion engines, and has contributed a number of papers to the Royal Society and to the scientific periodicals.

A SUMMER holiday course on hydro-electric installations and power transmission is to be given at the Polytechnic Institute of the University of Grenoble. The fee for the course is 110f., and the programme includes lectures on the general considerations for the establishment of hydraulic power stations ; on preparatory work for obtaining power ; on central hydro-electric power stations ; on the transmission of power ; and on the distribution of energy. Further particulars can be obtained from the Office National des Universités et Ecoles Françaises, 50, Russell-square, W.C.1.

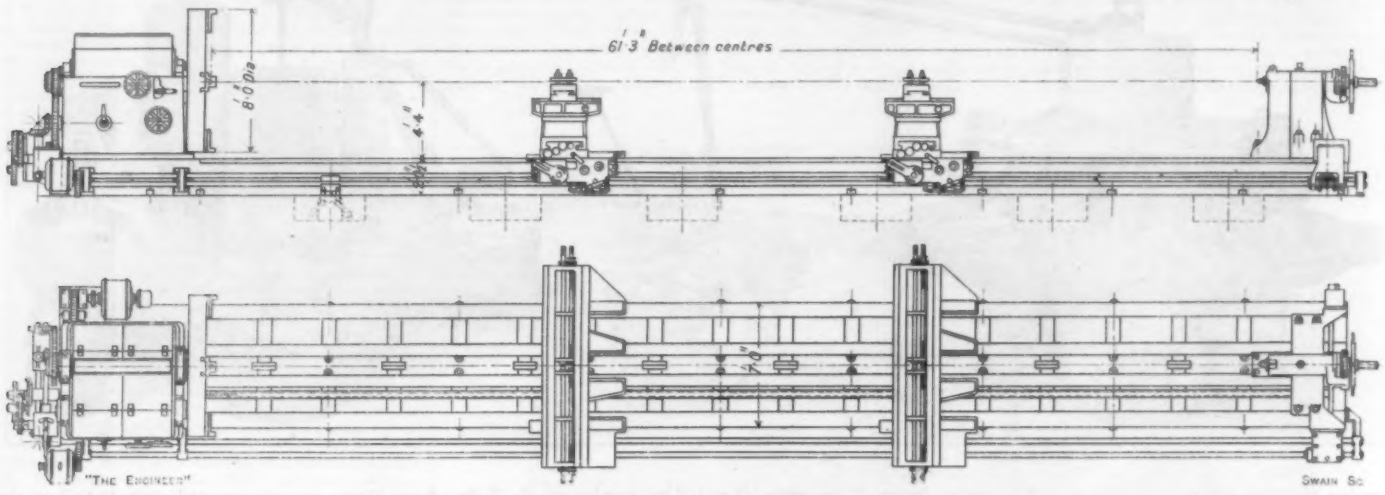
THE J. S. Fry and Sons, Limited, Colston Research Fellowship, Bristol University Faculty of Engineering, which provides for payment of fees and a maintenance allowance of £150 a year, has been awarded to Mr. Francis Baliol Wrightson, a student in the Faculty of Engineering.

SOME interesting experiments are, according to *Indian Engineering*, being carried out in Ceylon, in the employment of rubber for public thoroughfares, and if these experiments prove a success similar trials may be proceeded with in Calcutta and other parts of India. The municipal authorities in Colombo had been using tar and asphaltum to overcome the dust nuisance, but they cost from 8 to 10 cents per square foot of the road, and did not prove a great success. Asphaltum was introduced in Colombo last year, and although it was found to be the most effective application used hitherto, its cost was considerable, amounting from 35 to 40 cents per square foot of the road. The first of the new experiments is the use of a rubber mixture, and its efficacy is being tested on certain Colombo highways. The preparation is applied in the same manner as tar, and resembles it closely in appearance. After application, and before it hardens, the mixture is covered over with river sand to increase its durability. The second experiment is being made with rubber blocks. It is stated that rubber of a very inferior quality, mixed, if possible, with bark shavings, is the best for the manufacture of the blocks required, so that the cost will not be an insuperable objection.

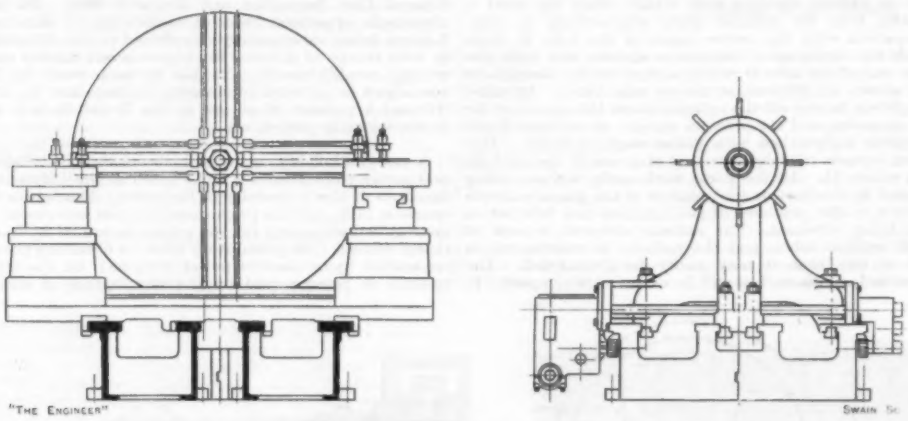
A Large All-Geared Double Bedded Lathe.

THE engravings below and on p. 723 illustrate a large double-bedded lathe for sliding, surfacing, screw-cutting, boring and chuck work, which has recently been completed for a foreign Government by G. and A. Harvey, Limited, of Govan, Glasgow. The lathe can swing 104in. over the bed and 80in. over the saddle, and can accommodate a length of 61ft. 3in. between its centres. It has a total weight of 113 tons exclusive of the electric motors.

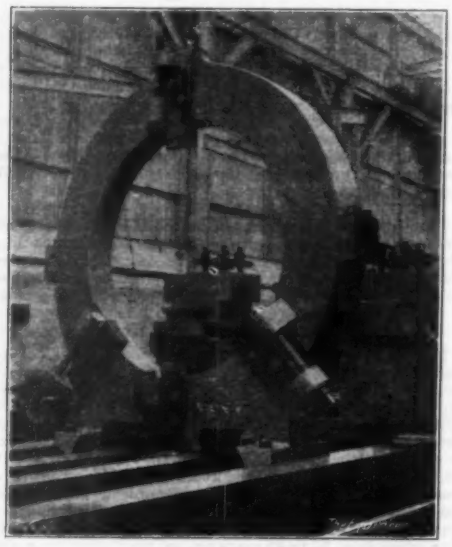
The bed is made in four pieces, the longitudinal and transverse joints by which it is divided being made by means of tongues and bolts. On the bed are supported the all-geared headstock, the tailstock, two saddles, each fitted with a front and rear compound slide, a large four-jaw stay, and a roller "steady." A second three-jaw stay,



ELEVATION AND PLAN OF 104-INCH DOUBLE BEDDED LATHE



CROSS-SECTION AND END ELEVATION



THREE-JAW STAY

shown separately in one of the engravings, is also supplied with the lathe.

The headstock is 7ft. long and 7ft. wide on the base. It is equipped with thrust brackets to prevent endwise movement, and with side pins for adjusting the longitudinal alignment. A powerful coil clutch is incorporated in the head to facilitate the starting up of the machine and the changing of the gears. As the motor is of the alternating-current type it may be run at full speed, while the machine is gradually started by means of the coil clutch. The clutch further enables the face plate to be "inched." Forced lubrication is supplied to the head by means of a pump delivering oil to an overhead distribution box whence pipes lead to all the bearings and wheels. The spindle, a hard steel forging running in gun-metal bushes, is formed near its front end with a large solid flange. The chuck or face plate is forced on to the end of the spindle and is fixed to the flange thereon by means of fitted bolts. The chuck is well ribbed on the rear face and is further stiffened by a deep ring cast on the back for the reception of the driving wheel. At the other end of the spindle thrust grooves are turned in it to fit projections in the gun-metal bearings. The chuck is equipped with four cast steel jaws, which can readily be reversed or removed. Each is operated independently of the others by means of a square-threaded screw and is held in position by four bolts. Driving power to the spindle is supplied by a 60 horse-power constant-speed motor through single, double, treble or quadruple gearing. There are twenty-four possible speeds for the chuck, ranging from 0.26 to 32.87 revolutions per minute.

The following is a list of some of the principal dimensions of the machine other than those already mentioned :—

Length of bed	75ft.
Breadth of bed	7ft.
Length overall	79ft. 6in.
Diameter of chuck	96in.
Front journal of spindle, diameter	16in.
Length	20in.
Back journal of spindle, diameter over collars	12in.
Length	15in.
Spindle speeds	0.26, 0.32, 0.39, 0.48, 0.60, 0.70, 0.91, 1.12, 1.36, 1.69, 2.11, 2.62, 3.25, 4.03, 4.88, 6.05, 7.75, 9.39, 11.3, 14.11, 17.07, 21.16, 26.36, 32.87 revolutions per minute
Screw-cutting feeds	1–10, 12, 14, 16, 18, 20, 24, 28, 32, 40 mm.
Tapers	1 in 300, 275, 250, 225, 200, 175, 150, 125, 100, 75, 50, 25, 20, 15, 10
Leading screw pitch	1in.
Floor space	80ft. by 14ft.

The saddles have bearings on all four ways of the bed, and at the front each has a portion extending over the bed for the purpose of accommodating the feed and traverse gear. Longitudinal self-acting feed motion and the screw-cutting feed are communicated to the saddles from a large screw driven from the spindle by a train of change wheels. At the tailstock end of the bed a cross shaft carries the motion of the screw to a side shaft, from which the transverse screws in the saddles can be driven for feeding the tools inwards or for surface cutting. In addition, the side shaft operates cross shafts lying parallel with the transverse screws. These cross shafts are connected to vertical shafts lying within the stools, which shafts in turn operate screws in the top longitudinal slides, which may thus be used for short parallel or taper turnings or borings. The second side shaft shown in the engravings is driven by an auxiliary 20 horse-power motor and is used to communicate rapid traversing motion to the saddles and the tailstock.

For long taper turning the longitudinal and transverse feed motions are combined at the saddle by means of change wheels. Tapers ranging from 1 in 300 to 1 in 10 can thus be turned.

One of the stays supplied with the machine accommodates work from 20in. to 36in. in diameter, while the other can take in work from 36in. to 60in. The roller "steady" can be adjusted to suit work over the whole range from 20in. to 60in.

The power equipment of the machine consists of a main squirrel cage three-phase motor developing 60 horse-power and an auxiliary 20 horse-power three-phase motor. The main motor is provided with an oil-immersed star delta starter and a no-volt and two overload releases.

ELECTRIC TRACTION IN SWITZERLAND.

(From our own Correspondent.)

IT is interesting to note, in connection with Sir Vincent L. Raven's papers on electric locomotives, including those of Switzerland, a statement just made in the Swiss Parliament about the saving effected by electric traction on the State or Federal Railways. When the report on the working and results of the Swiss Federal Railways came before Parliament a few days ago, during its usual June session, the Swiss Minister of Railways, Federal Councillor Haab, remarked that the results of electric traction during 1921 had proved better than was anticipated a year ago, which, he said, was partly due to the fall in the price of electric locomotives. Thus an electric locomotive, which used to cost from 800,000f. to 900,000f. (say, at the present rate of exchange, about £34,043 to £38,300), now costs only 500,000f. (say £21,278). Again, eighty electric locomotives, it is found by experience, are able to do the work for which a hundred steam locomotives used to be required. Moreover, it costs about 25 per cent. less to keep an electric locomotive in working order and repair than to keep a steam locomotive in order.

Another advantage of electric traction, for the Swiss in particular, with their long Alpine railway tunnels, is that such a line as the recently electrified Gotthard, with several tunnels, is easier and cheaper to supervise and maintain with electric traction owing to there being no longer any damage from smoke or steam.

It is doubtless as a result of electrification that there are now, I understand, 160 steam locomotives of the Federal Railways for sale. Hitherto such old stock has been sold through middlemen, to Czecho-Slovakia and such countries—a system which, it seems, has not answered very satisfactorily; and the Federal Railways, at their meeting in Berne on June 21st, discussed how best to dispose directly of superfluous locomotives and other material in future.

It also appeared in Parliament, from the report of the official reporters on the Federal Railways, that traffic receipts for 1921 were, in round numbers, 351,900,000f., that is, nearly 50,000,000f. less than in 1920, and 90,500,000f. less than estimated. Goods traffic fell off by 53,000,000f. (23.7 per cent.). The excess of working receipts over working expenditure was only about 10,000,000f., whereas the corresponding figure for 1920 was 35,700,000f. This gives, as the report admits, the worst traffic coefficient known on the Swiss Federal Railways since 1902. In 1913 the traffic coefficient was 66.94; in 1914, 73.66; and in 1921, actually 96.59. Since June, 1920, up to the end of last year the number of railway servants of all categories has been reduced by 1400, but several hundred more, it is stated, can still be dispensed with by means of better organisation.

What has swallowed up considerable sums of money which can ill be spared is the repairing of the vaulting of the Hauenstein base tunnel, between Basle and Olten, built originally by a German firm of contractors, and finished in 1914. This tunnel has now cost a total sum exceeding 30,000,000f., and it does not yet clearly appear how much more money will be required really to complete it.

AN article on "Safe British Railways" in *The Times* of Friday last compared the 130 persons killed in road accidents in London during the first three months of the present year with the 121 "persons killed on the railways for the whole of last year." This, however, is not comparing like with like; moreover, the figure 121 was in the returns for 1920. To compare people killed in the streets with people killed on the railways last year, the figure 726 must be used. In 1920 it was 906. The number injured on the railway was 5155 in 1921 and 7375 in 1920.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

The Trade Outlook.

THERE is a general disposition amongst iron and steel masters and manufacturers in this district to take a more hopeful view of the trade position, and a steady recovery is now being looked for. The tone of the Birmingham iron and steel market has improved during the past week or two, and values have been steadied, but it is realised that it will take some little time for the general trade to pick up again. Some people do not look for much change before the autumn, but signs are not wanting that it is coming. Producers hope that railway rates will come down and that taxation will be moderated, but they claim that any concessions made should be applied to ease the load which they are carrying. The position in regard to the engineering industry is still too precarious to inspire complete confidence, but hopes are entertained that after the recent struggle labour will be more reasonable, and that the outstanding questions will be settled without recourse to strike methods. It is thought that after the fair holidays are out of the way, buying may get going again, provided always that relations with labour are satisfactorily adjusted. The Midland engineer still suffers from the preferential advantage given to his competitor, and the question of removing works to the seaboard is actually under consideration. This is the main cause for regret hereabouts, and high railway rates are doing more to damp manufacturers' spirits than anything else. Unless some real relief is shortly forthcoming under the head of freights, it is quite possible that some concerns will remove their works nearer to the coast, to improve their competitive position in construction for export. The local Chambers of Commerce are continuing to press the railway companies, and serious attention is being given to all suggestions tending to the improvement of both road and water transport. The outlook in Coventry is not considered very encouraging, for the protracted struggle in the engineering industry had resulted in a very serious dislocation. The point which concerns all parties is whether the delay will put them out of the running altogether as far as the seasonal trade is concerned. Fortunately, the non-federated firms are as busy as ever, and there is no falling off in the orders for motor cars, motor cycles and cycles. The demand exists, and it is hoped that the determined efforts of the associated manufacturers to get into working order in time will be successful.

Improved Demand for Staffordshire Bar Iron.

Though the Staffordshire manufactured iron trade cannot be described as brisk, business continues to show a slight improvement, and there is a better demand for marked bars. There is no alteration in official prices, but the pressure of buyers is very insistent. Good grade unmarked bars show wide divergencies in prices. The old basis of £11 15s. is still quoted in a few cases, but this is much above the value which buyers put on even good merchant bars, transactions having been effected at substantially less than £11. While nut and bolt bars are nominally £10, a good line can be placed at about half-a-crown less. Similarly, with fencing iron, while the quotation is £10 2s. 6d., business might be placed at £10, provided it is a desirable order. The Belgians are again getting a share of the nut and bolt bar trade, their price being £8 17s. 6d. delivered Darlaston, against £10 asked by mills at home. This disparity is no new feature. Hitherto, the nut and bolt trade has been so uncertain that those engaged in it have preferred to buy raw material in very small quantities from Staffordshire and Lancashire. The fact that they are now taking advantage of the lower price of imported material will be interpreted as a sign that nut and bolt manufacturers are now able to see further ahead, and are consequently prepared to place orders for larger tonnages. It does not appear that the importations amount to very much. They are probably another phase of the pressure which has been exercised without cessation on prices at home. A slight improvement in foreign business in galvanised sheets has been observed during the past week, and this business looks like opening out.

Smelters and Railway Rates Burden.

The Midlands continues to lag behind Scotland and the North-East Coast in the matter of pig iron production. While several furnaces are about to be relighted in each of the latter districts, it seems unlikely for the present that any plant will be brought into operation in this area. In this district, the blast-furnacemen have not gone beyond a general preparation for immediate relighting, when the situation justifies this policy. There are bitter complaints of the hindrance to business caused by oppressive railway rates, and it is considered that the time has arrived when railway managers, who are said to be well aware of the position of makers and the amount of help they require to give them anything like appreciable assistance in a trade revival, should make a bold step on their own, without being unduly influenced by actuaries. The appeal by Lord Weir that railway men should assist trade recovery by accepting reductions, somewhat on the scale which has applied in the iron and steel and engineering industries, is generally supported. Those Midland smelters who are producing are just able to dispose of their output of foundry iron, without adding to their stocks. But there is a lot of reserve material to be got rid of, and this effectually prevents price increases. On the other hand, there is no inclination to shade prices, but the one or two firms who last week added 1s. per ton to their quotations do not appear to have met with any success. Pig iron users are said to be holding off. A few purchases of special brands have been made by merchants, signifying that in their opinion prices have touched bottom and may rebound. Business is still being withheld by others, who hold the belief that it will be possible to place contracts on more favourable terms by waiting. Buyers know that there are various directions in which the burdens of industry might be lightened—reduced railway rates are the most obvious relief—and they think that if this did happen and prices fell, it would be very exasperating to find themselves committed to huge expenditures on a higher basis. A significant feature of the business which is passing is the pressure for early delivery which accompanies nearly every order. This is taken by smelters as an indication of the very low stocks in the hands of consumers, and points to larger tonnages being called for in the near future. Shipments of Midland iron to the Continent are variable. Some smelters who are anxiously looking for means to avert the accumulation of stocks have had more difficulty lately in effecting sales to Germany and other continental consumers.

Business in Steel.

Midland steelmasters welcome the revival which, though small, is at last appearing in the steel trade. The Birmingham district will benefit in many ways as the result of the substantial business recently placed, chiefly with Scottish firms, by the home railways for rolling stock. The suggestion made in this letter a week ago that the steelmakers would restore the territorial "limits," restricting sales by steel works within their own areas, is now confirmed. The matter is of some concern to constructional engineers in this district, who have latterly taken advantage of free competition to obtain quotations from Middlesbrough and Glasgow. They are thankful, however, for the announcement that steelmakers are now prepared to supply constructional engineers with steel at export prices, provided a guarantee is given that the work on which the steel is to be used is on foreign account. This allays a rather sore grievance, a good deal of business having been lost because of the insistence by steelmakers on a price to home consumers sometimes exceeding the export figure by as much as £1 per ton. There has been an increase of foreign competition in the steel market of late, and continental billets and sheet bars have assumed rather more prominence. The price ranges from £7 to £7 5s. Welsh mills are still quoting £7 15s., in accordance with the official declaration, but buyers will not pay this except for welding qualities. Supplies are readily obtainable at £7 10s. A feature of the steel trade is the improved demand for various descriptions of mild steel wire. The mills are very busy, and indeed have a difficulty in satisfying customers in the matter of delivery.

Foundry Trades Exhibition.

It was computed that 25,000 persons visited the International Foundry Trades Exhibition at Birmingham, and of that number only 1 per cent. represented the general public. The main attendance consisted of those interested in the foundry trade—proprietors, executive and technical staffs and operatives—and it is hoped that the Exhibition will inculcate the spirit of research and enterprise among employers and operatives, and thereby produce a higher standard in the foundry in the future. The business done at the Exhibition was in excess of anticipations.

Obituary.

Midland engineers and manufacturers were sorry to learn of the death on the 23rd inst. of Mr. William Smith, chairman and managing director of Thomas Smith and Sons, Limited, of Saltley. Mr. Smith, who was a well-known Birmingham manufacturer, was born on July 11th, 1843, in Birmingham. During his lifetime he took a very active part in the cycle industry. During the war he undertook considerable work for the Government, and was highly praised for the assistance rendered in the production of articles for war purposes.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Outlook.

THERE is a distinct feeling of disappointment in the iron and metal markets here, which is, of course, the result of a much too optimistic view taken when it became certain that the engineering stoppage was at an end. Warnings were given in this and in other trade and technical columns that whereas three months ago there was work but no men to do it, now there might be men but no work to be done. This, of course, is an exaggerated way of putting it; but at the same time it is clear that there is serious lack of work for the men who are coming back. The consequence is that the demand for engineering material in this district fails to come up to the expectation of the market, and the pendulum of market opinion has swung back, so that perhaps people are now unduly pessimistic where they were unduly optimistic.

Copper.

The market has kept fairly steady, probably because there is nothing very definite to look forward to in either direction. Bears of copper may get a few pounds out of a successful operation, but there is no probability of any serious fall; and, on the other hand, the state of trade is unfavourable for the bulls. Hence speculative interest in the market is very much restricted. Consumers appear to be buying small lots just as they are needed, and are not yet beginning to consider the advisability of forming a stock for future use, although the reduction of the bank rate and the great cheapness of money render it much less expensive to hold a stock of copper than it used to be. The American position seems to suggest that the output of copper is now growing faster than the rate of consumption, and, of course, any advance upon the comparatively low prices of the metal depends upon reverse conditions. If there were a large European consumption it would no doubt be possible to sell the output, but are we justified in expecting a revival of European consumption this year? A return to normal consumption in Europe must wait until things have been got into some sort of order, and we make very slow progress in this direction. There has been no appreciable change in the official prices for manufactured copper and brass, and if manufacturers are to be credited in their contention that no undue profit is being made, then the costs of manufacturing are enormously greater than they should be. It must be admitted that this is dangerous for British trade, and if the conditions are not changed one can foresee the time when the country which supplies the world with raw copper will also supply the world with manufactured metals.

Tin.

The market for tin is steady and there does not seem to be any immediate probability of any serious change in prices. America is not likely to be a large buyer for some time, having secured as much as she will need, and it is still possible that the long-drawn-out coal strike in that country will limit the consumption. The demand from South Wales has been rather below the average of late, and there seems to be a probability of an increased visible supply when the next statistics are published. This may not lead to any fall in price, because the market is now on a fairly low level; but it will probably prevent any rise.

Lead and Spelter.

The prices for prompt lead keep up, but the market has had a rather a dull appearance during the last week. Rather large arrivals have occurred lately, but there is at present no clear indication as to the probable course of prices. Spelter has been a very steady market, but there has been very little activity either in buying or in selling.

Pig Iron.

The local market for foundry iron is decidedly quiet, and there seems to be rather less inquiry than when the engineers' shops were closed. One can only account for this by supposing that the anticipatory buying when it was known that the men were coming back was a little too extravagant. There is not so much work as was expected, and consequently we are suffering from the reaction which follows too extravagant hopes. One begins to doubt whether all the foundry iron made for this district is being sold or whether some accumulation is taking place. The make for this district is, of course, only small, and the foundry industry will be in a bad way if it cannot take all. Some improvement is reported in the demand for hematite iron, but this cannot be very decided while it is possible to buy East Coast hematite at 1s. or 2s. above the price of No. 3 common iron. Forge pig iron remains very much neglected, and hence one may assume that the Lancashire ironworks are not making much headway.

Finished Material.

Orders here for finished iron and steel come in slowly, and many of them are for small lots. There does not seem to be any disposition to place substantial contracts for future delivery. One could understand this in connection with manufactured iron, because it is probable that iron prices will have again to be reduced; but there is no margin now for much reduction in the prices of rectional steel. Perhaps the reason of the apathy of buyers is that there is no great amount of constructional business to look forward to.

Scrap.

There seems to be a little better inquiry for heavy wrought scrap, but the prices obtainable are still so low that it scarcely pays the dealer to give attention to this section of the scrap market. For foundry scrap the market is unchanged, and very little buying seems to be going on. Dealers generally quote 82s. 6d. and 85s. per ton for good broken machinery metal, but one would not like to say that there were no sellers at 80s. Steel scrap is quiet and is worth only about 50s. on trucks in this district.

South-East Lancashire Electricity Supply.

The second and final inquiry into the South-East Lancashire electricity supply scheme by the Electricity Commissioners was held last week in Manchester. This is the first scheme under the Electricity Act of 1919 to reach the second inquiry stage, and it is generally anticipated that it will be approved by both Houses of Parliament when it is submitted. In the early days of the formulation of the scheme the railway companies interested appeared to be favourable to the formation of an Advisory Board, but at the conference held last week both the Midland and the London and North-Western Railway Companies raised objections, the Midland objecting to any clauses which would enable the Advisory Board to control in any way its operations, and the London and North-Western protesting against a clause which made binding any decision of the Board confirmed on appeal by the Commissioners. Mr. P. M. Heath, the town clerk of Manchester, speaking on behalf of the great majority of the constituent authorities, said his clients regarded the electrification of railways as most important. Their generating stations should be part of the scheme. He asked whether the railway companies were to escape altogether from the general desire for a better electricity supply. Mr. Heath begged for permission to pay pensions to the officers and servants of the Board as well as compensation to members of the Advisory Board for loss of remunerative time. Mr. Heath also proposed the insertion of a clause requiring all constituent authorities to inform the Advisory Board of any fresh supply of power which it was intended to give. At present there was no such provision in the draft order. With last week's inquiry all discussion of the scheme is now at an end, and the findings of the Commissioners will be embodied in a Bill which will be submitted for the approval or otherwise of the legislature.

The Engineering Trades.

In many directions signs are evident of an improvement in the engineering trades of this district. Not the least important of these is the new work which is being placed in hand by the London and North-Western Railway Company at Crewe and Horwich, for instance, where

orders have been given for twenty locomotives of the latest express types. Although such an order would not have created much excitement a few years ago, at the present time any movement of this kind by the leading railway companies is regarded favourably, for it cannot fail to influence the engineering trade generally. Machine tool builders are hoping that the railway shops will soon be in the market for new and up-to-date tools, and it is quite probable that orders from this direction will shortly be forthcoming.

BARROW-IN-FURNESS, Thursday.

Hematites.

There is a better tone in the hematite iron trade already, and the number of inquiries are greater and more orders are being placed. The state of the trade is just what it was before the engineering and shipbuilding lock-out occurred, with this difference, the continental trade has improved in the interim. It is expected that the trade in mixed numbers will gradually develop until there is a fair amount of activity. The price of iron is favourable to bigger orders being placed instead of instructions to deliver small parcels or, in other words, living from hand to mouth. It is possible, in view of the favourable prices, that customers will order to stock. The trade in ingot moulds continues and shipments from Barrow are becoming regular.

Iron Ore.

There is not much life in the iron ore trade, and that which is being brought up is practically for local consumers. Trade will have to improve considerably before there is anything like full employment at the mines, many of which are still idle. Spanish ore is coming in in limited quantities and there is not a great trade at present.

Steel.

The steel trade shows slight improvement and the mills in West Cumberland are starting next week. The Barrow mills are moderately employed, with the exception of the hoop department, which is busy, comparatively speaking. More hoops have been shipped from Barrow. There has been a further shipment of rails for Ireland, but the quantities are not heavy.

Shipbuilding and Engineering.

Shipbuilding continues dull and there are no orders to report. The Cunard liner Servia, which was started at Vickers some time ago and on which there has been no work for some considerable time, still remains unfinished, and up to the present no instructions have been received to commence work on the vessel. In the engineering departments at Vickers one shop is engaged upon mining machinery, which will take some time to complete.

SHEFFIELD.

(From our own Correspondent.)

Brighter Outlook.

By that curious contradiction, in which Sheffield rejoices, a pall of smoke of daily increasing density betokens a gradual return to brighter conditions industrially. In fact, the east end of the city is now presenting somewhat approaching a normal aspect, and preparations are being made for a still more general resumption. At the time of writing, it is true, this increased activity is not reflected in any marked diminution in the figures of unemployed registered at the local exchange, but, as was pointed out in this column a week ago, the re-start is of necessity a somewhat slow process, as furnaces which deal with 60 tons of steel at a single melt cannot be re-lit with the same facility and expedition as a kitchen fire. Next week will witness a more general resumption. At the huge works of the United Steel Company, between Sheffield and Rotherham, for instance, six Siemens furnaces will shortly be started. It is feared, however, that work cannot yet be found fully to employ the twenty-three new Siemens-Martin steel furnaces which form one of the finest steel equipments in the country, nor can the Morgan continuous strip and bar mill, which again is one of the largest and biggest plants of its kind in the world, be worked at its full capacity, unless orders are far more plentiful than is at present the case. The billet mills will, however, be brought into operation almost immediately. There is a growing measure of confidence on the part of local employers as to the prospects. According to one of the leaders in the Sheffield and District Engineering Employers' Association, there is a great volume of business in the background, but its benefits cannot materialise until there is a better adjustment of wages. Mr. Arthur Balfour, head of the well-known firm of steel manufacturers, thinks it will be autumn before any considerable activity is experienced. Lord Aberconway does not, however, take a very hopeful view of the situation. He told the shareholders of John Brown and Co. on Tuesday that although the year just closed had been the worst in the history of the company, he was not sure that the present year would not be as bad. He could not anticipate good results in any of the firm's departments during the current year. There was, however, the hopeful sign that British manufacturing prices were considerably lower as compared with continental prices than he could have anticipated a year ago. English pig iron at from £4 to £5 a ton was half the price of a year ago, and now even lower than the Belgian product. There was, however, no profit at these prices—they were simply quoted in order to maintain trade. By the beginning of next year there might be perceptible an improvement in this country's foreign trade, but he did not believe that even then the financial results would be any more satisfactory. The output of John Brown's Atlas works was not one-third what it was the previous year, either in weight or value. They were, of course, seriously affected by the decision of the Washington Conference in regard to armaments. They had had to close certain seams in their collieries because of the men's impossible conditions, while there was the further handicap of the "preposterous railway rates."

Railways and Ships.

Although no orders of considerable magnitude have yet been placed by the home railways, there is an appreciable increase of activity in these departments, and the extension of certain of the London undergrounds—in connection with which new capital to the extent of £2,500,000 has been raised this week—provides some extremely welcome work for two or three ironfoundries on the Chesterfield side of Sheffield, which specialise in the casting of tube segments, of which, it is said, something like 40,000 to 50,000 tons will be required altogether. Another very useful order, in the benefits of which Sheffield steel works will share, is that secured by Cammell Laird and Co. from the Boston (U.S.A.) United Fruit Company, for the construction of three motor ships for the fruit-carrying trade, of which further particulars than those given last week are now available. The vessels are to be of about 4000 tons gross, and will be propelled by electric motors, the current being generated by Cammellaird-Fullagar Diesel engines. This combination of machinery, the makers state, marks a new era in this country in ship propulsion, and is certain to have a big influence on the future of marine engineering. It is claimed that the adoption of this combination of machinery effects an enormous reduction in fuel consumption, and greatly increases cubic space and deadweight capacity, while the machinery lends itself to the greatest flexibility of control.

Bringing Buyers to the Works.

Two of the oldest and best-known firms in the cutlery and tool trade conceived the idea of bringing their customers and prospective customers to Sheffield to see the processes of manufacture, and as a result a party of eighty members of the London and Suburban Ironmongers' Association spent a very instructive day in the city. It happened that the works selected are among the few which have been, and still are, busily engaged on their specialities. As was stated some time ago in this column, Messrs. Spear and Jackson have been working day and night on spade production, and they have now on hand very considerable orders for saws and other tools, including a large consignment of circular saws for Japan. In the cutlery trade the visitors found George Butler and Co., Limited, busy in the table knife and electro-plate departments, though in pocket knives, razors and scissors there are only sufficient orders to keep the works going on half time. This firm has just fitted out the two new ships of the White Star line, the Homeric and Majestic, with cutlery, consisting of hand-forged blades and ivory handles, and within the last week have received a large order from the Admiralty for similar goods. The annual Admiralty contracts are about to be placed for large quantities of tableware, including 70,000 white metal table forks, 60,000 nickel silver table spoons, 40,000 nickel silver teaspoons, 3000 table knives, &c.

A New Agricultural Machine.

Another demonstration which has been arranged by a well-known local firm of agricultural implement makers attracted considerable attention. This was a new double sickle, the invention of Mr. R. N. Sidebottom, of Brooklands, Cheshire. This can be adapted to any make of mowing machine with slight adjustments, and, it is is claimed, will revolutionise the present system of mowing, its cutting powers being, it is said, far in advance of anything made in this country or in America. The standard double sickle consists of two complete sickle blades, working one above the other, eliminating the finger plate, all cutting being done between the two sharp edges coming together, instead of a cut against a stationary plate, as in the ordinary machine. The knives are almost self-sharpening, and run much longer than the single knife without re-sharpening. Having two cutting edges, it will cut much closer to the ground, and remove "fog" or dead grass. The machine does not clog or get choked up, and is said to take much less horse-power than the ordinary machine. By its manufacture Messrs. Tyzack, Sons and Turner hope to bring yet another important industry to Sheffield.

Abortive Oil Boring.

By the sale of the boring, pumping and storage plant used in the recent quest for oil in North-East Derbyshire, the last of this abortive experiment has probably been heard. The sale was attended by representatives from oilfields in Burmah, Persia, Trinidad, Mexico, America and the Continent. Although the prices realised were in remarkable contrast to the figures which the Government had to pay for the plant in America during the war, a total of about £16,000 was reached. Storage tanks fetched particularly good prices, four of 160,000 gallons capacity realising an average of £510. The demand for boilers was slack, and horizontal steam engines, single-cylinder, 12in. by 12in., link motion, selling round about £30 each.

Fuels and Raw Materials.

The fuel position is still unchanged, the demand for industrial coal not yet having reduced the big stock at the pits to any marked extent, though slacks, as a result of irregular output, show an improvement from the point of view of the collieries. The steel makers still say there can be no material improvement in their trade until cheaper coal is obtainable, while the colliery proprietors say that wages and rail charges are making the pits unprofitable. The scrap situation is also a somewhat serious one from the steel makers' point of view. The bad slump, followed by the stoppage of engineering operations, reduced the accumulation of scrap down to the minimum, and this was soon absorbed by South Wales and Germany. Pig iron production has also been severely restricted, and the shortage of raw materials will prove a formidable factor in trade recovery. The alloy market is also stagnant, the tool steel branches of the steel and engineering trades not as yet showing any signs of recovery.

NORTH OF ENGLAND.

(From our own Correspondent.)

Important Orders for Railway Stock.

WHILST progress towards restoration of normal trade is slow, it is gratifying to record that indication is not lacking of movement in the right direction. Idle plant is gradually being set in motion, and the general outlook is certainly more encouraging than for some time past. At the same time, however, expressions of regret are heard that the improvement is not more rapid. The outstanding feature in trade circles in the North of England this week has been the placing of important orders for railway rolling stock. The increasing activity in this particular branch of industry is very welcome in view of the very lean times which have been experienced for some considerable time past. It is well known, however, that some of the railway companies have in hand big schemes for renewing their rolling stock, and now that trade conditions are becoming more stabilised it is confidently expected that they will come forward with a considerable amount of work. Messrs. Stephenson and Company, of Darlington, have received an order for ten tank engines for the North British Railway Company, Glasgow, while the Tees-side Bridge and Engineering Works, Limited, of Middlesbrough, have secured a contract for 100 open goods wagons and twenty-five covered goods wagons of the I.R.C.A. standard. This firm have previously had orders from local works for numbers of steel wagons, and contracts for other railway material for wagons and locomotives, but this is the first order for main line rolling stock for India, of the new standard, to be made in the Middlesbrough district.

Large Oil Tanks Ordered.

The Tees-side Bridge and Engineering Works, Limited, have also secured a contract for fifteen large oil storage tanks to be erected at Singapore. Competition for this work was exceptionally keen, and from amongst the many tenderers the Admiralty selected the Tees-side firm. Some idea of the importance of the work will be gathered from the fact that each of the fifteen tanks is 116ft. in diameter, and has a capacity of 3,000,000 gallons. The firm are already engaged in erecting six similar tanks at Singapore, where they have an erection staff. Thus the firm is in a very fortunate position, every department of the works being assured of employment for some months to come.

Cleveland Iron Trade.

The position in the Cleveland pig iron trade certainly shows some improvement, but not on the scale that was generally anticipated. There has been as yet little acceleration of demand as a sequel to the end of the labour troubles, and nothing has occurred to warrant the blowing in of more furnaces. There are several about ready to start, but ironmasters will not face the risk of lighting up until there is a reasonable prospect of the output being absorbed. Meanwhile home business continues within narrow limits. Scottish consumers are buying very sparingly, and, indeed, there are reports of Belgian and Midland iron competing in the markets beyond the Tweed. The export trade, however, keeps fairly good. Further large shipments of Cleveland and special iron are being made to the United States. Prompt orders for all classes of iron, except No. 1 Cleveland, can be executed. No. 1 foundry iron is almost unobtainable, and as soon as any is produced it is promptly snapped up. Prices are firmly maintained, No. 1 and siliceous iron being 95s., No. 3 G.M.B. 90s., No. 4 foundry 87s. 6d., No. 4 forge 85s., and mottled and white 80s.

Hematite Pig Iron.

The hematite pig iron trade is more active, one or two buyers being prepared to discuss forward business. Germany, too, continues to take fair quantities, and in order to realise stocks some low prices have been accepted for export. For the home trade, however, 94s. per ton is the minimum for mixed numbers, and 95s. for No. 1.

Iron-making Materials.

There is little or no demand for foreign ore, consumers being well stocked. Best Rubio ore is now offered at 26s. per ton c.i.f. Tees, which represents a fall of 1s. per ton on the week. Coke is somewhat firmer, and demand has a tendency to outstrip the supply. It is still possible, however, to purchase good Durham furnace qualities at 26s. 6d. per ton delivered at the works.

Manufactured Iron and Steel.

The outlook in the manufactured iron and steel trade is distinctly better. None of the works are operating at full capacity, but more orders are coming to hand, and there is a prospect of more continuous working for the plant in operation, whilst there is also some hope that at no distant date a few more idle works will re-start. An important concession is the decision to permit home prices to be cut to the export basis, where steel is required by bridge builders and others for foreign contracts. This will enable fabricated steel works to compete on more equal terms in the markets of the world.

The Coal Trade.

The Northern coal trade position is, if anything, a shade better all round. There is on the whole a rather brighter outlook, though it is more than a little difficult to account for it. The volume of actual business booked or under close discussion is still very limited, and many of the collieries, particularly in Durham, are experiencing a very anxious time, while a considerable loss of time at the pits is very common. Still, there is a feeling abroad that the worst is past, and that better trade should soon be experienced. There are at the moment a few fairly heavy preliminary inquiries for Germany, Greece and the United States, while one or two Scandinavian contracts for steams are in process of being placed, so that the outlook is a little clearer, though it is not by any means reflected in any

improvement in prices, with the sole exception of best brands of steam coals, which are well booked up for the present. A very steady tone is maintained throughout the Northumberland steam coal trade, with the exception of second steams, which rule only quiet, but so far as can be gathered there is not much contracting ahead. Buyers for the most part are content to cover their requirements from week to week. The Durham market continues generally weak and depressed. Best grades of gas coals are moderately steady, as well as superior classes of bunkers, but second gas, coking, and all ordinary sorts of bunkers are plentiful, and can be discounted. Coke is, on the whole, fairly steady for almost every class, and in the case of good patent oven foundries and gas coke the demand is fairly good.

SCOTLAND.

(From our own Correspondent.)

General Dulness.

In almost all departments of industry conditions are unchanged, and markets dull. Recent price reductions have perhaps brought out more inquiries, but actual business is practically as scarce as ever. The day-to-day system of buying is still very general, consumers being altogether averse to committing themselves further. Works and shipyards are very short of new work, but there seems to be a confident feeling that an improvement will be noticed after the holidays are over.

Electric Scaling.

Last week a demonstration of the Sandblom electric scaling hammer—a Swedish invention not hitherto used in this country—was given in the ship-repairing works of Messrs. Alex. Stephen and Sons, Govan, Glasgow. The invention consists of a spindle making 1200 revolutions per minute, and carrying on its outer end a number of short chains each terminating in a small hammer head. An electric motor, of such light construction that it may be held and used by one workman, supplies the driving power. The chains are thrown out by centrifugal force, and with the spindle held parallel and close to a steel plate the hammer heads strike at the rate of 10,000 blows per minute. All scale and rust can be much more quickly and perfectly removed than by either the hand or pneumatic scalers. For the apparatus it is claimed that it provides the most rapid and efficient method of removing scale, rust, and old paint from all iron and steel work, ships, bridges, girders, gasometers, &c. The demonstration was attended by representatives of the Glasgow Corporation, the Caledonian Railway Company, the Clyde Navigation Trustees, Lloyd's Registry of Shipping, and many shipbuilding and repairing firms.

New Dutch Liner.

At the end of last week Messrs. Barclay, Curle and Co., Glasgow, launched the steamer Flandria, 10,000 tons, for the Royal Holland Lloyd Line. The steamer has accommodation for 215 first-class, 110 second-class, 100 intermediate, and 900 third-class passengers. The propelling machinery consists of two sets of Brown-Curtis double-reduction geared turbines. The cargo will be handled by a silent-working system of hydraulic cranes. The steamer is intended for mail and passenger service between Amsterdam and South American ports.

Pig Iron.

Scotch pig iron makers are having a very quiet time. The expected demand for hematite has not yet materialised, and the turnover is chiefly confined to foundry qualities. The latter have now more inquiry on export account, but local makers show little activity. Prices are firm. At the weekly meeting of the Glasgow pig iron ring there were sellers of Scotch No. 3 G.M.B. at 98s. 6d. f.a.s. Glasgow; No. 3 G.M.B. Cleveland at 90s. f.o.b. Middlesbrough; and mixed numbers East Coast hematite at 95s. f.o.b. Middlesbrough. No business was reported.

Steel and Iron.

Prospects for steel sheets seem somewhat brighter. Prices tend easier and export inquiries are on the increase, with more probability of orders to follow. Galvanised sheets are doing very little, and inquiries are few meantime. Steel plates and sectional material are just barely moving. Malleable bar iron makers are more confident. Orders have been placed with local consumers which must mean business for the malleable works sooner or later. The export demand continues to show a slight improvement. A reduction in Scotch prices is expected. The steel branch of the malleable iron industry is fairly busy. The demand for scrap has fallen off somewhat. This may be owing to the approach of the holidays, but some are of the opinion that buyers are looking for cheaper prices. Scrap, however, is not too plentiful, and holders maintain a firm attitude.

Coal.

Conditions in the coal trade are practically unaltered. All grades of round coal are very short of orders, and colliery sidings are congested with loaded wagons. Consequently a considerable amount of idle time is prevalent in all distri . Prices of large coal are unsteady, and buyers can still obtain good concessions for prompt business. Holders, however, are not disposed to do forward business at current rates. The export demand for washed nuts continues to provide the chief source of turnover. These sorts are not too plentiful, and are firm in price. Shipments from the Clyde and the Tay are largely coastwise, but clearances from the Forth show an almost equal proportion of export to coastwise cargoes. A good business is passing in large nuts for shipment to Hamburg. Aggregate shipments for the week amounted to 278,002 tons against 296,433 tons in the preceding week, and 313,260 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

The immediate prospects, so far as the coal export trade is concerned, are far from bright; in fact, they are gloomier than was the case a week ago. The inquiry itself is more restricted, and there is no indication of any material expansion, while the activities of the miners tend to trouble in the near future, which, of course, is not good for trade. Consumers abroad will naturally feel somewhat nervous about operating if they think that delivery of the supplies which they require are at all likely to be jeopardised, and the result will be that they will prefer to look to other producing centres where shipment is not likely to be hampered by strikes and stoppages. As a matter of fact, intermittent stoppages of collieries are now becoming pretty frequent, on account of the lack of trade, and this contributes towards making fresh business more and more difficult. The position is that colliery companies cannot continue cutting their prices to induce sales which do not materialise, and prices are so unremunerative that coalowners must call a halt somewhere. Furthermore, there is always the danger that once a colliery has stopped working on account of the shortage of the demand, there is no telling when it will resume operations. They will not be disposed to do so for the sake of the sale of one or two small cargoes, and will require to see that the prospects of a steady flow of business at satisfactory prices are good. As things are, this is not the case. At the moment of writing, there is no definite news regarding the placing of the order for the supply of 15,000 tons of locomotive steam coals for shipment July, August and September for the Norwegian State Railways, but from the prices which have gone in it cannot be said that the chances of the business coming to South Wales are bright, as there is a difference between the lowest figure for best Admiralty double-screened large, and the lowest tenders for Lambton South Hetton, and South Yorkshire Associations of 4s. 6d. to 5s. per ton, and it cannot be said that the difference in quality is equal to this.

Miners' Demands.

The South Wales Miners' Federation held their annual conference last week, and, of course, passed a number of resolutions making important demands, few, if any, of which the industry can stand in its present unsatisfactory state. The miners are prepared to lay the whole industry idle to accomplish their end of making all workmen at the collieries members of the Federation. Despite their impoverished condition, they threaten to make trade even worse than it is now, for it is well known that the damage done by a strike lasts far longer than the duration of the actual stoppage of work. It is admitted by one of the men's leaders that between 80 and 90 per cent. of the miners who are at present employed are members of the organisation, but, of course, there are thousands of men who are unemployed and have no means of paying their contributions, even if they rejoin the Federation. Nevertheless, it is the decision of the conference that all miners are to tender fourteen days' notice on July 10th to compel all non-members to fall into line, so that if the mere threat of a strike does not have the desired effect, there is the prospect of a stoppage towards the end of next month. On the question of wages, the conference decided to press for an immediate advance of 60 per cent. above the 1914 rate, and also to endeavour to bring about a better state of things so far as the lower-paid workmen are concerned. One of the men's leaders has declared that they would not hesitate to call on every worker throughout the country to rally to their aid. It is admitted that a 60 per cent. increase will force an immediate crisis in the mining industry, as it means setting aside the present agreement with its allowance of only 28 per cent. As to the sanctity of agreements, the attitude of the leaders, or, at any rate, some of them, is that there can be no sanctity in agreements that do not provide a living wage. Other conference resolutions included the hardy annual that a six-hour shift and a five-day week should be established, with the addition that an endeavour should be made to secure a two-weeks' holiday with full pay; that coalowners should recognise that membership of the Federation should be made a condition of employment at the collieries; that an effort should be again made to obtain payment for small coal; that an arrangement be arrived at by the Conciliation Board to secure that coal should not be sold below an agreed figure to be fixed by the Board. This last resolution follows on the prevalent idea which is being fostered by some of the leaders that the fall in the export price of coal is due to the unnecessary competition of the colliery salesmen, oblivious of the fact that the demand for coal from abroad is totally inadequate to meet present production, and that the majority of collieries in the steam coal area are not paying.

Dock Charges.

In a statement issued by the secretary of the South Wales Coalowners' Association—Mr. Finlay Gibson—it is pointed out that under the Bill now before Parliament, it was hoped that power would be given to traders to appeal, if they so desired, to the Rates Advisory Committee for further reductions, and that such provision would come into operation immediately the Bill passed into law. Representatives of the coalowners recently had an interview with the Ministry of Transport, and urged that traders should have the right to appeal to the Rates Advisory Committee earlier than February, 1923, but the reply was to the effect that there was no prospect or possibility of any alteration in the existing laws, under which railway-owned docks are entitled to continue their existing charges until February, 1923. The anomalous position therefore created by this announcement is that while there will be a right conceded to traders to appeal immediately for a redress of grievances at docks and harbours that are not railway-owned, they will be denied that right for a period of probably at least another nine months at docks which are railway-owned. The whole question is to be considered by the South Wales "General" Committee at its next meeting, when the adoption of further steps for the protection of the interests of traders will be discussed.

Steel Workers' Wages.

The general audit of the South Wales and Monmouthshire Iron and Steel Workers for the three months ended May 31st last shows that an increase in wages is due to the workmen who come under the sliding scale of 4 per cent. as and from July 1st next, making it 55½ per cent.

Current Business.

During the past week there has been no improvement in any branch of the steam coal market, and the tone is extremely quiet. Numerous collieries are working short time because they cannot get on prompt business and reduce their standing stocks. Consumers abroad are not operating, more especially as the foreign exchanges are working to their disadvantage. It is quite the exception to find a colliery that can see the prospect of regular working for a week ahead. Still, salesmen are fighting sternly against cutting their prices, knowing that they are already unremunerative, and that to reduce them further only means greater losses. Best Admiralty large can be secured at 26s. and even a shade under, and ordinary qualities are quoted at 25s. to 25s. 3d. Superior small coals are relatively steadier than large descriptions, on account of the fact that the reduced working of large coals means that the quantity of small coals is restricted. Patent fuel and coke keeps about the same, without any very great activity.

Latest News from the Provinces.

WALES AND ADJOINING COUNTIES.

Coal Prices.

The South Wales coalowners have considered a report presented by the Commercial Committee concerning market conditions and selling prices, and as a result the Committee has been given instructions to give the matter its further immediate attention with a view to stabilising and preventing unnecessary reductions in prices. It was reported that the threat of the miners to give notices on July 10th had already had a prejudicial effect on the market.

Swansea Metal Exchange.

The conditions in the tin-plate market show no change, but prices keep firm. There is, however, a good number of mills idle, which means that many workmen are unemployed. The galvanised sheet market is quiet.

Catalogues.

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, New York, U.S.A.—Pamphlet on "Westinghouse Sub-station and Transmission Equipment."

THE REES ROTURBO MANUFACTURING COMPANY, Limited, Wolverhampton.—Pamphlet No. R 197, descriptive of rotary jet condensers and vacuum pumps.

THE SCOTTISH TUBE COMPANY, Limited, 34, Robertson-street, Glasgow.—Pamphlet, entitled "Instructions for Heating 'Armco' Quality Ingot Iron Tubes."

WELCO PATENTS, 150, Alma-street, Birmingham.—Folder dealing with the following electrical subjects:—Kettles, hot plates, bowl fires and heaters, irons and toasters.

E. S. RUSSELL AND CO., 243, Great College-street, Camden Town, N.W. 1.—Pamphlet which treats of the Russell domestic water heater, combined with the electric lighting supply.

NOBEL INDUSTRIES, Limited, Nobel House, Buckingham-gate, S.W. 1.—Booklet published for Thermit, Limited, 155, Church-road, Battersea, S.W. 11, on the welding of rails.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—A meeting of the Institution of Municipal and County Engineers will be held in the Scottish District at Perth on Thursday, Friday and Saturday, July 6th, 7th and 8th next. The following programme has been arranged:—On the Thursday, at 8.30 p.m., there will be a business meeting in the Station Hotel, Perth. On the Friday morning, at 10 a.m., the members will be received by the Lord Provost and Magistrates of the City of Perth, in the Council Hall, City Chambers, 3, High-street, Perth, after which there will be a discussion on the following papers:—(1) "Municipal Works in Perth," by Mr. Thomas M'Laren, burgh engineer, Perth; (2) "Notes on the Training of a Highway Engineer," by Mr. Geo. S. Barry, F.S.I., F.I.G.A., district road surveyor, Ayr; (3) "Compulsory Town Planning," by Mr. Wm. A. Macartney, A.M. Inst. C.E., burgh engineer, Dumbarton; (4) "Modern Transport," by Mr. Hugh McDiarmid, district road surveyor, Dunfermline; (5) "Organisation and *Personnel*," by Mr. A. Forbes, county road surveyor, Kincardineshire, and Mr. Jas. Andrew, county road surveyor, Dumbartonshire; "Plant," by Mr. Wm. Ellacott, county road surveyor, Midlothian; and "Local Materials," by Mr. Jas. Lang, county road surveyor, Ayrshire. At 1 p.m. there will be a luncheon in the Station Hotel, Perth, provided by the Corporation of the City of Perth; and at 2.30 p.m. the discussion on the papers referred to above will be continued. At 3.30 p.m. there will be alternative visits to (a) municipal works in Perth, including (1) Trinidad asphalt roads recently constructed and in course of construction; (2) water pumping station; (3) cleansing department electric vehicles; (4) Trinidad asphalt mixing plant in Corporation yard; (5) Darnhill Drive housing site and new tennis courts; (6) public wash-houses, Canal-street; and (b) to putting greens at North and South Inches; bowling green, South Inch; Moncreiffe Island and Craigiehill golf courses, or Kinnoull Hill. At 5 p.m. tea will be provided in the City Hall, followed by (a) cinematograph film illustrating the Trinidad asphalt industry and process of road construction; (b) microscopic lantern slides showing sections of local whinstone used in road construction; and at 7.45 p.m. the annual dinner will be held in the Station Hotel, Perth. On the Saturday, at 9 a.m., there will be a visit by motor char-à-banc to proposed site of the lower generating station, Grampian electricity supply scheme, on the river Tummel, and to Loch Rannoch which is to be raised in level several feet.

orders have been given for twenty locomotives of the latest express types. Although such an order would not have created much excitement a few years ago, at the present time any movement of this kind by the leading railway companies is regarded favourably, for it cannot fail to influence the engineering trade generally. Machine tool builders are hoping that the railway shops will soon be in the market for new and up-to-date tools, and it is quite probable that orders from this direction will shortly be forthcoming.

BARROW-IN-FURNESS, Thursday.

Hematites.

There is a better tone in the hematite iron trade already, and the number of inquiries are greater and more orders are being placed. The state of the trade is just what it was before the engineering and shipbuilding lock-out occurred, with this difference, the continental trade has improved in the interim. It is expected that the trade in mixed numbers will gradually develop until there is a fair amount of activity. The price of iron is favourable to bigger orders being placed instead of instructions to deliver small parcels or, in other words, living from hand to mouth. It is possible, in view of the favourable prices, that customers will order to stock. The trade in ingot moulds continues and shipments from Barrow are becoming regular.

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There is not much life in the iron ore trade, and that which is being brought up is practically for local consumers. Trade will have to improve considerably before there is anything like full employment at the mines, many of which are still idle. Spanish ore is coming in in limited quantities and there is not a great trade at present.

Steel.

The steel trade shows slight improvement and the mills in West Cumberland are starting next week. The Barrow mills are moderately employed, with the exception of the hoop department, which is busy, comparatively speaking. More hoops have been shipped from Barrow. There has been a further shipment of rails for Ireland, but the quantities are not heavy.

Shipbuilding and Engineering.

Shipbuilding continues dull and there are no orders to report. The Cunard liner Servia, which was started at Vickers some time ago and on which there has been no work for some considerable time, still remains unfinished, and up to the present no instructions have been received to commence work on the vessel. In the engineering departments at Vickers one shop is engaged upon mining machinery, which will take some time to complete.

SHEFFIELD.

(From our own Correspondent.)

Brighter Outlook.

By that curious contradiction, in which Sheffield rejoices, a pall of smoke of daily increasing density betokens a gradual return to brighter conditions industrially. In fact, the east end of the city is now presenting somewhat approaching a normal aspect, and preparations are being made for a still more general resumption. At the time of writing, it is true, this increased activity is not reflected in any marked diminution in the figures of unemployed registered at the local exchange, but, as was pointed out in this column a week ago, the re-start is of necessity a somewhat slow process, as furnaces which deal with 60 tons of steel at a single melt cannot be re-lit with the same facility and expedition as a kitchen fire. Next week will witness a more general resumption. At the huge works of the United Steel Company, between Sheffield and Rotherham, for instance, six Siemens furnaces will shortly be started. It is feared, however, that work cannot yet be found fully to employ the twenty-three new Siemens-Martin steel furnaces which form one of the finest steel equipments in the country, nor can the Morgan continuous strip and bar mill, which again is one of the largest and biggest plants of its kind in the world, be worked at its full capacity, unless orders are far more plentiful than is at present the case. The billet mills will, however, be brought into operation almost immediately. There is a growing measure of confidence on the part of local employers as to the prospects. According to one of the leaders in the Sheffield and District Engineering Employers' Association, there is a great volume of business in the background, but its benefits cannot materialise until there is a better adjustment of wages. Mr. Arthur Balfour, head of the well-known firm of steel manufacturers, thinks it will be autumn before any considerable activity is experienced. Lord Aberconway does not, however, take a very hopeful view of the situation. He told the shareholders of John Brown and Co. on Tuesday that although the year just closed had been the worst in the history of the company, he was not sure that the present year would not be as bad. He could not anticipate good results in any of the firm's departments during the current year. There was, however, the hopeful sign that British manufacturing prices were considerably lower as compared with continental prices than he could have anticipated a year ago. English pig iron at from £4 to £5 a ton was half the price of a year ago, and now even lower than the Belgian product. There was, however, no profit at these prices—they were simply quoted in order to maintain trade. By the beginning of next year there might be perceptible an improvement in this country's foreign trade, but he did not believe that even then the financial results would be any more satisfactory. The output of John Brown's Atlas works was not one-third what it was the previous year, either in weight or value. They were, of course, seriously affected by the decision of the Washington Conference in regard to armaments. They had had to close certain seams in their collieries because of the men's impossible conditions, while there was the further handicap of the "preposterous railway rates."

Railways and Ships.

Although no orders of considerable magnitude have yet been placed by the home railways, there is an appreciable increase of activity in these departments, and the extension of certain of the London undergrounds—in connection with which new capital to the extent of £2,500,000 has been raised this week—provides some extremely welcome work for two or three ironfoundries on the Chesterfield side of Sheffield, which specialise in the casting of tube segments, of which, it is said, something like 40,000 to 50,000 tons will be required altogether. Another very useful order, in the benefits of which Sheffield steel works will share, is that secured by Cammell Laird and Co. from the Boston (U.S.A.) United Fruit Company, for the construction of three motor ships for the fruit-carrying trade, of which further particulars than those given last week are now available. The vessels are to be of about 4000 tons gross, and will be propelled by electric motors, the current being generated by Cammellaird-Fullagar Diesel engines. This combination of machinery, the makers state, marks a new era in this country in ship propulsion, and is certain to have a big influence on the future of marine engineering. It is claimed that the adoption of this combination of machinery effects an enormous reduction in fuel consumption, and greatly increases cubic space and deadweight capacity, while the machinery lends itself to the greatest flexibility of control.

Bringing Buyers to the Works.

Two of the oldest and best-known firms in the cutlery and tool trade conceived the idea of bringing their customers and prospective customers to Sheffield to see the processes of manufacture, and as a result a party of eighty members of the London and Suburban Ironmongers' Association spent a very instructive day in the city. It happened that the works selected are among the few which have been, and still are, busily engaged on their specialities. As was stated some time ago in this column, Messrs. Spear and Jackson have been working day and night on spade production, and they have now on hand very considerable orders for saws and other tools, including a large consignment of circular saws for Japan. In the cutlery trade the visitors found George Butler and Co., Limited, busy in the table knife and electro-plate departments, though in pocket knives, razors and scissors there are only sufficient orders to keep the works going on half time. This firm has just fitted out the two new ships of the White Star line, the Homeric and Majestic, with cutlery, consisting of hand-forged blades and ivory handles, and within the last week have received a large order from the Admiralty for similar goods. The annual Admiralty contracts are about to be placed for large quantities of tableware, including 70,000 white metal table forks, 60,000 nickel silver table spoons, 40,000 nickel silver teaspoons, 3000 table knives, &c.

A New Agricultural Machine.

Another demonstration which has been arranged by a well-known local firm of agricultural implement makers attracted considerable attention. This was a new double sickle, the invention of Mr. R. N. Sidebottom, of Brooklands, Cheshire. This can be adapted to any make of mowing machine with slight adjustments, and, it is is claimed, will revolutionise the present system of mowing, its cutting powers being, it is said, far in advance of anything made in this country or in America. The standard double sickle consists of two complete sickle blades, working one above the other, eliminating the finger plate, all cutting being done between the two sharp edges coming together, instead of a cut against a stationary plate, as in the ordinary machine. The knives are almost self-sharpening, and run much longer than the single knife without re-sharpening. Having two cutting edges, it will cut much closer to the ground, and remove "fog" or dead grass. The machine does not clog or get choked up, and is said to take much less horse-power than the ordinary machine. By its manufacture Messrs. Tyzack, Sons and Turner hope to bring yet another important industry to Sheffield.

Abortive Oil Boring.

By the sale of the boring, pumping and storage plant used in the recent quest for oil in North-East Derbyshire, the last of this abortive experiment has probably been heard. The sale was attended by representatives from oilfields in Burmah, Persia, Trinidad, Mexico, America and the Continent. Although the prices realised were in remarkable contrast to the figures which the Government had to pay for the plant in America during the war, a total of about £16,000 was reached. Storage tanks fetched particularly good prices, four of 160,000 gallons capacity realising an average of £510. The demand for boilers was slack, and horizontal steam engines, single-cylinder, 12in. by 12in., link motion, selling round about £30 each.

Fuels and Raw Materials.

The fuel position is still unchanged, the demand for industrial coal not yet having reduced the big stock at the pits to any marked extent, though slacks, as a result of irregular output, show an improvement from the point of view of the collieries. The steel makers still say there can be no material improvement in their trade until cheaper coal is obtainable, while the colliery proprietors say that wages and rail charges are making the pits unprofitable. The scrap situation is also a somewhat serious one from the steel makers' point of view. The bad slump, followed by the stoppage of engineering operations, reduced the accumulation of scrap down to the minimum, and this was soon absorbed by South Wales and Germany. Pig iron production has also been severely restricted, and the shortage of raw materials will prove a formidable factor in trade recovery. The alloy market is also stagnant, the tool steel branches of the steel and engineering trades not as yet showing any signs of recovery.

NORTH OF ENGLAND.

(From our own Correspondent.)

Important Orders for Railway Stock.

WHILST progress towards restoration of normal trade is slow, it is gratifying to record that indication is not lacking of movement in the right direction. Idle plant is gradually being set in motion, and the general outlook is certainly more encouraging than for some time past. At the same time, however, expressions of regret are heard that the improvement is not more rapid. The outstanding feature in trade circles in the North of England this week has been the placing of important orders for railway rolling stock. The increasing activity in this particular branch of industry is very welcome in view of the very lean times which have been experienced for some considerable time past. It is well known, however, that some of the railway companies have in hand big schemes for renewing their rolling stock, and now that trade conditions are becoming more stabilised it is confidently expected that they will come forward with a considerable amount of work. Messrs. Stephenson and Company, of Darlington, have received an order for ten tank engines for the North British Railway Company, Glasgow, while the Tees-side Bridge and Engineering Works, Limited, of Middlesbrough, have secured a contract for 100 open goods wagons and twenty-five covered goods wagons of the I.R.C.A. standard. This firm have previously had orders from local works for numbers of steel wagons, and contracts for other railway material for wagons and locomotives, but this is the first order for main line rolling stock for India, of the new standard, to be made in the Middlesbrough district.

Large Oil Tanks Ordered.

The Tees-side Bridge and Engineering Works, Limited, have also secured a contract for fifteen large oil storage tanks to be erected at Singapore. Competition for this work was exceptionally keen, and from amongst the many tenderers the Admiralty selected the Tees-side firm. Some idea of the importance of the work will be gathered from the fact that each of the fifteen tanks is 116ft. in diameter, and has a capacity of 3,000,000 gallons. The firm are already engaged in erecting six similar tanks at Singapore, where they have an erection staff. Thus the firm is in a very fortunate position, every department of the works being assured of employment for some months to come.

Cleveland Iron Trade.

The position in the Cleveland pig iron trade certainly shows some improvement, but not on the scale that was generally anticipated. There has been as yet little acceleration of demand as a sequel to the end of the labour troubles, and nothing has occurred to warrant the blowing in of more furnaces. There are several about ready to start, but ironmasters will not face the risk of lighting up until there is a reasonable prospect of the output being absorbed. Meanwhile home business continues within narrow limits. Scottish consumers are buying very sparingly, and, indeed, there are reports of Belgian and Midland iron competing in the markets beyond the Tweed. The export trade, however, keeps fairly good. Further large shipments of Cleveland and special iron are being made to the United States. Prompt orders for all classes of iron, except No. 1 Cleveland, can be executed. No. 1 foundry iron is almost unobtainable, and as soon as any is produced it is promptly snapped up. Prices are firmly maintained, No. 1 and siliceous iron being 95s., No. 3 G.M.B. 90s., No. 4 foundry 87s. 6d., No. 4 forge 85s., and mottled and white 80s.

Hematite Pig Iron.

The hematite pig iron trade is more active, one or two buyers being prepared to discuss forward business. Germany, too, continues to take fair quantities, and in order to realise stocks some low prices have been accepted for export. For the home trade, however, 94s. per ton is the minimum for mixed numbers, and 95s. for No. 1.

Iron-making Materials.

There is little or no demand for foreign ore, consumers being well stocked. Best Rubio ore is now offered at 26s. per ton c.i.f. Tees, which represents a fall of 1s. per ton on the week. Coke is somewhat firmer, and demand has a tendency to outstrip the supply. It is still possible, however, to purchase good Durham furnace qualities at 26s. 6d. per ton delivered at the works.

Manufactured Iron and Steel.

The outlook in the manufactured iron and steel trade is distinctly better. None of the works are operating at full capacity, but more orders are coming to hand, and there is a prospect of more continuous working for the plant in operation, whilst there is also some hope that at no distant date a few more idle works will re-start. An important concession is the decision to permit home prices to be cut to the export basis, where steel is required by bridge builders and others for foreign contracts. This will enable fabricated steel works to compete on more equal terms in the markets of the world.

The Coal Trade.

The Northern coal trade position is, if anything, a shade better all round. There is on the whole a rather brighter outlook, though it is more than a little difficult to account for it. The volume of actual business booked or under close discussion is still very limited, and many of the collieries, particularly in Durham, are experiencing a very anxious time, while a considerable loss of time at the pits is very common. Still, there is a feeling abroad that the worst is past, and that better trade should soon be experienced. There are at the moment a few fairly heavy preliminary inquiries for Germany, Greece and the United States, while one or two Scandinavian contracts for steams are in process of being placed, so that the outlook is a little clearer, though it is not by any means reflected in any

improvement in prices, with the sole exception of best brands of steam coals, which are well booked up for the present. A very steady tone is maintained throughout the Northumberland steam coal trade, with the exception of second steams, which rule only quiet, but so far as can be gathered there is not much contracting ahead. Buyers for the most part are content to cover their requirements from week to week. The Durham market continues generally weak and depressed. Best grades of gas coals are moderately steady, as well as superior classes of bunkers, but second gas, coking, and all ordinary sorts of bunkers are plentiful, and can be discounted. Coke is, on the whole, fairly steady for almost every class, and in the case of good patent oven foundries and gas coke the demand is fairly good.

SCOTLAND.

(From our own Correspondent.)

General Dulness.

In almost all departments of industry conditions are unchanged, and markets dull. Recent price reductions have perhaps brought out more inquiries, but actual business is practically as scarce as ever. The day-to-day system of buying is still very general, consumers being altogether averse to committing themselves further. Works and shipyards are very short of new work, but there seems to be a confident feeling that an improvement will be noticed after the holidays are over.

Electric Scaling.

Last week a demonstration of the Sandblom electric scaling hammer—a Swedish invention not hitherto used in this country—was given in the ship-repairing works of Messrs. Alex. Stephen and Sons, Govan, Glasgow. The invention consists of a spindle making 1200 revolutions per minute, and carrying on its outer end a number of short chains each terminating in a small hammer head. An electric motor, of such light construction that it may be held and used by one workman, supplies the driving power. The chains are thrown out by centrifugal force, and with the spindle held parallel and close to a steel plate the hammer heads strike at the rate of 10,000 blows per minute. All scale and rust can be much more quickly and perfectly removed than by either the hand or pneumatic scalers. For the apparatus it is claimed that it provides the most rapid and efficient method of removing scale, rust, and old paint from all iron and steel work, ships, bridges, girders, gasometers, &c. The demonstration was attended by representatives of the Glasgow Corporation, the Caledonian Railway Company, the Clyde Navigation Trustees, Lloyd's Registry of Shipping, and many ship-building and repairing firms.

New Dutch Liner.

At the end of last week Messrs. Barclay, Curle and Co., Glasgow, launched the steamer Flandria, 10,000 tons, for the Royal Holland Lloyd Line. The steamer has accommodation for 215 first-class, 110 second-class, 100 intermediate, and 900 third-class passengers. The propelling machinery consists of two sets of Brown-Curtis double-reduction geared turbines. The cargo will be handled by a silent-working system of hydraulic cranes. The steamer is intended for mail and passenger service between Amsterdam and South American ports.

Pig Iron.

Scotch pig iron makers are having a very quiet time. The expected demand for hematite has not yet materialised, and the turnover is chiefly confined to foundry qualities. The latter have now more inquiry on export account, but local makers show little activity. Prices are firm. At the weekly meeting of the Glasgow pig iron ring there were sellers of Scotch No. 3 G.M.B. at 98s. 6d. f.a.s. Glasgow; No. 3 G.M.B. Cleveland at 90s. f.o.b. Middlesbrough; and mixed numbers East Coast hematite at 95s. f.o.b. Middlesbrough. No business was reported.

Steel and Iron.

Prospects for steel sheets seem somewhat brighter. Prices tend easier and export inquiries are on the increase, with more probability of orders to follow. Galvanised sheets are doing very little, and inquiries are few meantime. Steel plates and sectional material are just barely moving. Malleable bar iron makers are more confident. Orders have been placed with local consumers which must mean business for the malleable works sooner or later. The export demand continues to show a slight improvement. A reduction in Scotch prices is expected. The steel branch of the malleable iron industry is fairly busy. The demand for scrap has fallen off somewhat. This may be owing to the approach of the holidays, but some are of the opinion that buyers are looking for cheaper prices. Scrap, however, is not too plentiful, and holders maintain a firm attitude.

Coal.

Conditions in the coal trade are practically unaltered. All grades of round coal are very short of orders, and colliery sidings are congested with loaded wagons. Consequently a considerable amount of idle time is prevalent in all districts. Prices of large coal are unsteady, and buyers can still obtain good concessions for prompt business. Holders, however, are not disposed to do forward business at current rates. The export demand for washed nuts continues to provide the chief source of turnover. These sorts are not too plentiful, and are firm in price. Shipments from the Clyde and the Tay are largely coastwise, but clearances from the Forth show an almost equal proportion of export to coastwise cargoes. A good business is passing in large nuts for shipment to Hamburg. Aggregate shipments for the week amounted to 278,002 tons against 296,433 tons in the preceding week, and 313,260 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

The immediate prospects, so far as the coal export trade is concerned, are far from bright; in fact, they are gloomier than was the case a week ago. The inquiry itself is more restricted, and there is no indication of any material expansion, while the activities of the miners tend to trouble in the near future, which, of course, is not good for trade. Consumers abroad will naturally feel somewhat nervous about operating if they think that delivery of the supplies which they require are at all likely to be jeopardised, and the result will be that they will prefer to look to other producing centres where shipment is not likely to be hampered by strikes and stoppages. As a matter of fact, intermittent stoppages of collieries are now becoming pretty frequent, on account of the lack of trade, and this contributes towards making fresh business more and more difficult. The position is that colliery companies cannot continue cutting their prices to induce sales which do not materialise, and prices are so unremunerative that coalowners must call a halt somewhere. Furthermore, there is always the danger that once a colliery has stopped working on account of the shortage of the demand, there is no telling when it will resume operations. They will not be disposed to do so for the sake of the sale of one or two small cargoes, and will require to see that the prospects of a steady flow of business at satisfactory prices are good. As things are, this is not the case. At the moment of writing, there is no definite news regarding the placing of the order for the supply of 15,000 tons of locomotive steam coals for shipment July, August and September for the Norwegian State Railways, but from the prices which have gone in it cannot be said that the chances of the business coming to South Wales are bright, as there is a difference between the lowest figure for best Admiralty double-screened large, and the lowest tenders for Lambton South Hetton, and South Yorkshire Associations of 4s. 6d. to 5s. per ton, and it cannot be said that the difference in quality is equal to this.

Miners' Demands.

The South Wales Miners' Federation held their annual conference last week, and, of course, passed a number of resolutions making important demands, few, if any, of which the industry can stand in its present unsatisfactory state. The miners are prepared to lay the whole industry idle to accomplish their end of making all workmen at the collieries members of the Federation. Despite their impoverished condition, they threaten to make trade even worse than it is now, for it is well known that the damage done by a strike lasts far longer than the duration of the actual stoppage of work. It is admitted by one of the men's leaders that between 80 and 90 per cent. of the miners who are at present employed are members of the organisation, but, of course, there are thousands of men who are unemployed and have no means of paying their contributions, even if they rejoin the Federation. Nevertheless, it is the decision of the conference that all miners are to tender fourteen days' notice on July 10th to compel all non-members to fall into line, so that if the mere threat of a strike does not have the desired effect, there is the prospect of a stoppage towards the end of next month. On the question of wages, the conference decided to press for an immediate advance of 60 per cent. above the 1914 rate, and also to endeavour to bring about a better state of things so far as the lower-paid workmen are concerned. One of the men's leaders has declared that they would not hesitate to call on every worker throughout the country to rally to their aid. It is admitted that a 60 per cent. increase will force an immediate crisis in the mining industry, as it means setting aside the present agreement with its allowance of only 28 per cent. As to the sanctity of agreements, the attitude of the leaders, or, at any rate, some of them, is that there can be no sanctity in agreements that do not provide a living wage. Other conference resolutions included the hardy annual that a six-hour shift and a five-day week should be established, with the addition that an endeavour should be made to secure a two-weeks' holiday with full pay; that coalowners should recognise that membership of the Federation should be made a condition of employment at the collieries; that an effort should be again made to obtain payment for small coal; that an arrangement be arrived at by the Conciliation Board to secure that coal should not be sold below an agreed figure to be fixed by the Board. This last resolution follows on the prevalent idea which is being fostered by some of the leaders that the fall in the export price of coal is due to the unnecessary competition of the colliery salesmen, oblivious of the fact that the demand for coal from abroad is totally inadequate to meet present production, and that the majority of collieries in the steam coal area are not paying.

Dock Charges.

In a statement issued by the secretary of the South Wales Coalowners' Association—Mr. Finlay Gibson—it is pointed out that under the Bill now before Parliament, it was hoped that power would be given to traders to appeal, if they so desired, to the Rates Advisory Committee for further reductions, and that such provision would come into operation immediately the Bill passed into law. Representatives of the coalowners recently had an interview with the Ministry of Transport, and urged that traders should have the right to appeal to the Rates Advisory Committee earlier than February, 1923, but the reply was to the effect that there was no prospect or possibility of any alteration in the existing laws, under which railway-owned docks are entitled to continue their existing charges until February, 1923. The anomalous position therefore created by this announcement is that while there will be a right conceded to traders to appeal immediately for a redress of grievances at docks and harbours that are not railway-owned, they will be denied that right for a period of probably at least another nine months at docks which are railway-owned. The whole question is to be considered by the South Wales "General" Committee at its next meeting, when the adoption of further steps for the protection of the interests of traders will be discussed.

Steel Workers' Wages.

The general audit of the South Wales and Monmouthshire Iron and Steel Workers for the three months ended May 31st last shows that an increase in wages is due to the workmen who come under the sliding scale of 4 per cent. as and from July 1st next, making it 55½ per cent.

Current Business.

During the past week there has been no improvement in any branch of the steam coal market, and the tone is extremely quiet. Numerous collieries are working short time because they cannot get on prompt business and reduce their standing stocks. Consumers abroad are not operating, more especially as the foreign exchanges are working to their disadvantage. It is quite the exception to find a colliery that can see the prospect of regular working for a week ahead. Still, salesmen are fighting sternly against cutting their prices, knowing that they are already unremunerative, and that to reduce them further only means greater losses. Best Admiralty large can be secured at 26s. and even a shade under, and ordinary qualities are quoted at 25s. to 25s. 3d. Superior small coals are relatively steadier than large descriptions, on account of the fact that the reduced working of large coals means that the quantity of small coals is restricted. Patent fuel and coke keeps about the same, without any very great activity.

Latest News from the Provinces.

WALES AND ADJOINING COUNTIES.

Coal Prices.

The South Wales coalowners have considered a report presented by the Commercial Committee concerning market conditions and selling prices, and as a result the Committee has been given instructions to give the matter its further immediate attention with a view to stabilising and preventing unnecessary reductions in prices. It was reported that the threat of the miners to give notices on July 10th had already had a prejudicial effect on the market.

Swansea Metal Exchange.

The conditions in the tin-plate market show no change, but prices keep firm. There is, however, a good number of mills idle, which means that many workmen are unemployed. The galvanised sheet market is quiet.

Catalogues.

Westinghouse Electric International Company, New York, U.S.A.—Pamphlet on "Westinghouse Sub-station and Transmission Equipment."

The Rees Roturbo Manufacturing Company, Limited, Wolverhampton.—Pamphlet No. R 197, descriptive of rotary jet condensers and vacuum pumps.

The Scottish Tube Company, Limited, 34, Robertson-street, Glasgow.—Pamphlet, entitled "Instructions for Heating 'Armco' Quality Ingot Iron Tubes."

Welco Patents, 150, Alma-street, Birmingham.—Folder dealing with the following electrical subjects:—Kettles, hot plates, bowl fires and heaters, irons and toasters.

E. S. Russell and Co., 243, Great College-street, Camden Town, N.W. 1.—Pamphlet which treats of the Russell domestic water heater, combined with the electric lighting supply.

Nobel Industries, Limited, Nobel House, Buckingham-gate, S.W. 1.—Booklet published for Thermit, Limited, 155, Church-road, Batterses, S.W. 11, on the welding of rails.

The Institution of Municipal and County Engineers.—A meeting of the Institution of Municipal and County Engineers will be held in the Scottish District at Perth on Thursday, Friday and Saturday, July 6th, 7th and 8th next. The following programme has been arranged:—On the Thursday, at 8.30 p.m., there will be a business meeting in the Station Hotel, Perth. On the Friday morning, at 10 a.m., the members will be received by the Lord Provost and Magistrates of the City of Perth, in the Council Hall, City Chambers, 3, High-street, Perth, after which there will be a discussion on the following papers:—(1) "Municipal Works in Perth," by Mr. Thomas M'Laren, burgh engineer, Perth; (2) "Notes on the Training of a Highway Engineer," by Mr. Geo. S. Barry, F.S.I., F.I.G.A., district road surveyor, Ayr; (3) "Compulsory Town Planning," by Mr. Wm. A. Macartney, A.M. Inst. C.E., burgh engineer, Dumbarton; (4) "Modern Transport," by Mr. Hugh McDiarmid, district road surveyor, Dunfermline; (5) "Organisation and *Personnel*," by Mr. A. Forbes, county road surveyor, Kincardineshire, and Mr. Jas. Andrew, county road surveyor, Dumbartonshire; "Plant," by Mr. Wm. Ellacott, county road surveyor, Midlothian; and "Local Materials," by Mr. Jas. Lang, county road surveyor, Ayrshire. At 1 p.m. there will be a luncheon in the Station Hotel, Perth, provided by the Corporation of the City of Perth; and at 2.30 p.m. the discussion on the papers referred to above will be continued. At 3.30 p.m. there will be alternative visits to (*a*) municipal works in Perth, including (1) Trinidad asphalt roads recently constructed and in course of construction; (2) water pumping station; (3) cleansing department electric vehicles; (4) Trinidad asphalt mixing plant in Corporation yard; (5) Darnhill Drive housing site and new tennis courts; (6) public wash-houses, Canal-street; and (*b*) to putting greens at North and South Inches; bowling green, South Inch; Moncreiffe Island and Craigiehill golf courses, or Kinnoull Hill. At 5 p.m. tea will be provided in the City Hall, followed by (*a*) cinematograph film illustrating the Trinidad asphalt industry and process of road construction; (*b*) microscopic lantern slides showing sections of local whinstone used in road construction; and at 7.45 p.m. the annual dinner will be held in the Station Hotel, Perth. On the Saturday, at 9 a.m., there will be a visit by motor char-à-banc to proposed site of the lower generating station, Grampian electricity supply scheme, on the river Tummel, and to Loch Rannoch which is to be raised in level several feet.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	25/-
(1) Spanish	25/-
(1) N. African	25/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	26/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	5 8 9	—
No. 1 Foundry	5 0 0	—
No. 3 ,,	4 15 0	—
N.E. COAST—		
Hematite Mixed Nos.	4 14 0	4 14 0
No. 1	4 15 0	4 15 0
Cleveland—		
No. 1	4 15 0	4 15 0
Silicious Iron	4 15 0	4 15 0
No. 3 G.M.B.	4 10 0	4 10 0
No. 4 Foundry	4 7 6	4 7 6
No. 4 Forge	4 5 0	4 5 0
Mottled	4 0 0	4 0 0
White	4 0 0	4 0 0
MIDLANDS.		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
Part Mine Forge	*None offering.*	
North Staffs. No. 3 F'dry	4 5 0 to 4 10 0	
(3) Northampton—		
Foundry Nos. 2 and 1	*Nominal.*	
,, No. 3	4 0 0	—
,, Forge	3 10 0 to 3 12 6	
(3) Derbyshire—		
No. 3 Foundry	4 0 0 to 4 2 6	
Forge	3 12 6 to 3 15 0	
(3) Lincolnshire—		
Basic	4 0 0 to 4 5 0	
Foundry	4 5 0 to 4 10 0	
Forge	4 2 6 to 4 5 0	
(4) N.W. COAST—		
N. Lancs. and Cum.		
Hematite Mixed Nos.	5 15 0	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	11 0 0	10 15 0
Best ,,	12 0 0	—
N.E. COAST—		
Crown Bars	12 0 0	—
Tees	10 10 0	—
LANCS.—		
Crown Bars	11 10 0	—
Second Quality Bars	10 5 0	—
Hoops	14 0 0	13 15 0
S. YORKS.—		
Crown Bars	12 0 0	—
Best ,,	13 0 0	—
Hoops	14 0 0	—
MIDLANDS—		
Crown Bars	11 10 0 to 11 15 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolt Bars	10 0 0 to 10 5 0	
Gas Tube Strip	11 0 0 to 11 5 0	
Hoops (*Nom.*)	14 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 10 0	—
Ship Plates ⅜in. and up	10 0 0	—
Sections	9 10 0	—
Steel Sheets ⅞in. to ½in.	11 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	16 0 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	10 0 0	—
Angles	9 10 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	14 10 0	—
Channels	14 10 0	—
Hard Billets	8 15 0	—
Soft Billets	7 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 10 0	—
Light ,,	11 0 0 to 13 0 0	
Billets	9 5 0	—
Ship Plates	10 0 0	—
Boiler ,,	13 10 0	—
MANCHESTER—		
Bars (Round)	9 10 0 to 11 10 0	
,, (others)	10 10 0 to 11 10 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	12 5 0	12 0 0
Plates	9 10 0 to 11 0 0	
,, (Lancs. Boiler)	15 10 0	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Bessemer Billets	12 10 0	—
Hard Basic	8 15 0	—
Soft ,,	7 15 0	—
Hoops	12 5 0	—
Soft Wire Rods	11 0 0	—
MIDLANDS—		
Small Rolled Bars	9 5 0 to 9 10 0	
Bessemer Billets	7 10 0 to 7 12 6	
Hoops	11 10 0 to 12 0 0	
Gas Tube Strip	10 5 0 to 10 10 0	
Sheets (24 W.G.)	12 10 0	—
Galv. Sheets (f.o.b. L'pool)	16 0 0	—
Angles	9 10 0	—
Joists	10 0 0	—
Tees	10 10 0	—
Bridge and Tank Plates	10 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	19/6 to 19/9
Block Tin (cash)	152 7 6
,, (three months)	153 7 6
Copper (cash)	61 10 0
,, (three months)	62 0 0
Spanish Lead (cash)	24 7 6
,, (three months)	23 10 0
Spelter (cash)	27 15 0
,, (three months)	27 12 6
MANCHESTER—	
Copper, Best Selected Ingots	68 0 0
,, Electrolytic	70 0 0
,, Strong Sheets	94 0 0
,, Loco Tubes	0 1 1½
Brass Loco Tubes	0 0 11½
,, Condenser	0 1 2½
Lead, English	26 0 0
,, Foreign	25 0 0

FERRO ALLOYS,

(*All prices now nominal*).

	Per Ton.	Per Unit
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£27	10/-
,, 6 p.c. to 8 p.c. ,,	£25 10 0	9/-
,, 8 p.c. to 10 p.c. ,,	£24 10 0	8/-
,, Specially Refined		
Max. 2 p.c. carbon	£65	26/-
,, 1 p.c. ,,	£80	30/-
,, 0·75 p.c. carbon	£85	37/-
,, carbon free	1 1 per lb.	
Metallic Chromium	5/3 per lb.	
Ferro Manganese	(per ton) £15 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£13 0 0 scale 5/- per unit	
,, ,, 75 p.c.	£24 10 0 scale 6/- per unit	
,, Vanadium	18/- per lb.	
,, Molybdenum	6/6 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£180	
Cobalt	11/- per lb.	
Aluminium (per ton)	£110 to £120 (British Official).	

FUELS.

	SCOTLAND.	Export.
LANARKSHIRE—		
(f.o.b. Glasgow)—Steam		17 9
,, ,, Ell		18/-
,, ,, Splint		19/- to 22/-
,, ,, Trebles		20/
,, ,, Doubles		19/-
,, ,, Singles		18/3
AYRSHIRE—		
(f.o.b. Ports)—Steam		17,9
,, ,, Splint		19/-
,, ,, Trebles		20/-
FIFESHIRE—		
(f.o.b. Methil or Burntisland)—Steam		17/9 to 21/6
Screened Navigation		26/-
Trebles		20/-
Doubles		19/3
Singles		18/6
LOTHIANS—		
(f.o.b. Leith)—Best Steam		19/-
Secondary Steam		18/-
Trebles		20/6
Doubles		19/3
Singles		18/6
	ENGLAND.	
(8) N.W. COAST—		
Steams		33/-
Household		40/- to 61/-
Coke		34/-
NORTHUMBERLAND—		
Best Steams		22/6 to 24/-
Second Steams		20/6 to 21/6
Steam Smalls		13/- to 15/-
Unscreened		20/6
Household		25/- to 28/-
DURHAM—		
Best Gas		21/6 to 22/-
Second		18/6 to 21/6
Household		25/- to 28/-
Foundry Coke		32/6 to 35/-
SHEFFIELD—	INLAND.	
S. Yorks. Best Steam Hards	22/- to 23/-	—
Derbyshire Hards	20/- to 21/-	—
Seconds	18/- to 20/-	—
Cobbles	17/- to 19/-	—
Nuts	16/- to 18/-	—
Washed Smalls	10/- to 11/-	—
Best Hard Slacks	12/- to 13/-	—
Seconds ,,	9/- to 10/6	—
Soft Nutty ,,	7/6 to 8/6	—
Pea ,,	7/- to 8/-	—
Small ,,	2/- to 4/6	—
House, Branch	36/- to 37/6	—
,, Best Silkstone	33/- to 34/-	—
Blast Furnace Coke (Inland and Export)	19/- to 21/-	
CARDIFF—	(9) SOUTH WALES.	
Steam Coals:		
Best Smokeless Large		25/6 to 26/-
Second ,, ,,		25/- to 25/6
Best Dry Large		25/- to 25 6
Ordinary Dry Large		23/6 to 24/6
Best Black Vein Large		25/- to 25/6
Western Valley ,,		25/- to 25/6
Best Eastern Valley Large		24/6 to 25/-
Ordinary ,, ,,		23/- to 24/-
Best Steam Smalls		18/- to 18,6
Ordinary ,,		15/- to 17/-
Washed Nuts		22/6 to 25/-
No. 3 Rhondda Large		27,6 to 28,6
,, ,, Smalls		20/- to 21/-
No. 2 ,, Large		22/6 to 23,6
,, ,, Through		19/- to 20/-
,, ,, Smalls		14/- to 15/-
Coke (export)		34/- to 35/-
Patent Fuel		25/- to 27,6
Pitwood (ex ship)		30/- to 31/-
SWANSEA—		
Anthracite Coals:		
Best Large		50/- to 52 6
Seconds		40/- to 42 6
Red Vein		30/- to 32/6
Big Vein		42,6 to 47,6
Machine-made Cobbles		57/6 to 60/-
Nuts		55/- to 57,6
Beans		37/6 to 40/-
Peas		24/- to 26/-
Breaker Duff		8/- to 8/6
Rubbly Culm		15 6 to 16/-
Steam Coals:		
Large		22/- to 24/-
Seconds		20,- to 22/6
Smalls		14/- to 16/-
Cargo Through		18,- to 20,-

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England.

(7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

French Engineering Notes.

(From our Correspondent in Paris.)

Commercial Treaties.

THE signing of a commercial treaty between France and Spain last week was the first step that has been taken in the carrying out of a programme of separate short-period treaties with different countries. The negotiations have been particularly long and arduous, and for some months commercial relations between France and Spain were completely suspended, with such disastrous results that very considerable efforts had to be made on both sides to conciliate conflicting interests. The French have not obtained all that they desired, but the concessions are sufficiently important to allow of a resumption of business under much better conditions than existed before the rupture of the former treaty. In the case of French goods entering Spain there are reductions of 20 per cent. on the minimum tariff for small tools; from 10 to 20 per cent. on steam engines according to weight; of 14.28 to 29 per cent. on locomotives according to weight and gauge; of 10 per cent. on machine tools up to 5 tons in weight and 20 per cent. above; and up to 40 per cent. on motor cars according to price. The only other treaty concluded has been with Poland, which, of course, presented no difficulties; but with Belgium the negotiations appear to be no easier than those with Spain, for despite statements to the effect that there are prospects of an early settlement, the frequent suspension of negotiations proves that the difficulties are of a serious character. The principle of the French system of patchwork treaties was bound to meet with considerable opposition, for the reason that it does not put all countries on the same footing, and as the object of the French Government is to obtain specially favoured treatment for goods exported to particular countries, it follows that there is always a risk of reciprocal advantages being accorded for certain manufactures imported into France from some of those countries to the detriment of others. It is true that efforts are made to provide against this risk, but the system is so complicated that there is a fear of advantages in respect to import duties into France being nullified by future treaties with other countries. It is obvious that Great Britain, like Belgium, cannot accept a treaty that may eventually place it at a disadvantage with regard to foreign competitors; but if Belgium should accept a "commercial arrangement" it may be assumed that the guarantees offered will be sufficient to warrant Great Britain consenting to negotiate with France on similar lines.

Arsenal Reforms.

The cost to the country of arsenals that have so little to do that all sorts of expedients are adopted to find employment for highly paid men has been so severely criticised that the Government decided a long while ago to suppress two of the establishments and to carry out economies in the others. Shipbuilding in the arsenals is notoriously more costly than in private yards, and there has been a strong agitation in favour of handing over all work to private industry. The Government, however, insists on maintaining the majority of the arsenals, and a report upon its scheme has just been presented to the Chamber of Deputies by M. de Chappedelaine. The six existing arsenals are at Cherbourg, Brest, Lorient, Rochefort, Toulon and Bizerte. There are three State factories at Guérigny, Indret, and Ruelle. In 1914 these nine establishments employed 33,400 hands, which number was increased in 1918 to 65,000. This year, however, it has been reduced to 30,278. Amongst the reforms proposed is the transference of the Rochefort arsenal to private industry, the State maintaining only just what is required for repairs and other work necessary for local coast defence. The works at Guérigny will also be leased to private firms, and the manufacture of chains, which was its speciality, will be transferred to Indret. The Cherbourg arsenal will be practically suppressed, and will be used only for repairs to ships in the port. Both the Lorient and Bizerte arsenals will be considerably reduced, while even at Brest and Toulon there will be a diminution in the staffs. It is expected that these reforms will realise an economy of 50 million francs a year, while the disposal of the unnecessary plant and machinery will bring in about 100 million francs.

The Merchant Marine.

In a recent communication to the Académie de Marine by M. de Rousiers upon the situation of the merchant marine, it was stated that towards the middle of 1921 there was a tonnage of 2,543,635 tons, which was nearly the pre-war total. Since the liquidation of the State fleet and the surrendering of German ships the total had risen to 3,500,000 tons. Although this would place France in the front rank amongst maritime countries, the tonnage might give an exaggerated idea of the value of the fleet, for a large proportion of the ships is not modern, and many of the vessels are not serviceable. The tonnage is not in excess of the normal, and the present crisis is due to the phenomenal decline of the French shipping trade, as well as to the impossibility of French shipowners competing for foreign freights so long as they are burdened with the eight hours' day and other heavy charges from which foreign shipowners are exempt. Experience has shown that it is quite impossible to maintain the eight hours' day in the marine, and shipowners are therefore urging that the operations of the law should be suspended until the eight hours' day is adopted in the merchant marines of other countries.

Automatic Couplings.

Since the Minister of Public Works decided upon carrying out tests with automatic couplings in the hope of being able to select a type that could be adopted universally, the Technical Commission of Railways has been long examining the various apparatus submitted. No fewer than 404 proposals for automatic couplings were sent in, and after a long process of elimination there were only five left for final selection. These have now been reduced to two—the Boirault and the Henricot. These two systems of automatic couplings are to be fitted to a large number of wagons on different lines with a view of seeing which of the two can be definitely adopted.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

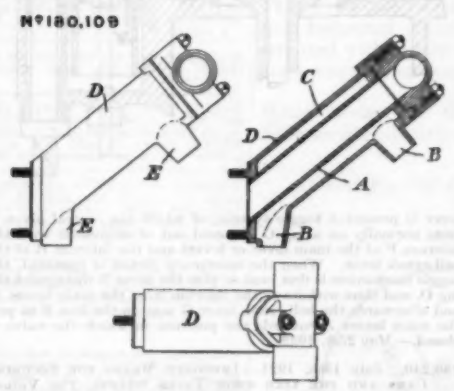
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

180,109. March 10th, 1921.—IMPROVEMENTS IN OR RELATING TO JACKETED CONDUITS AND TO THE MANUFACTURE OF THE SAME, Brown and Barlow, Limited, of Westwood-road, Witton, Birmingham, and Clement Brown, of 19, Trinity-road, Birchfield, Birmingham.

THE conduit described in this specification is particularly applicable to the induction pipes of internal combustion engines. A length of drawn copper or other tube A is encircled by a sand core—not shown—having projections at or near its extremities adapted to form inlets and outlets B to the jacket space C.

Nº180,109



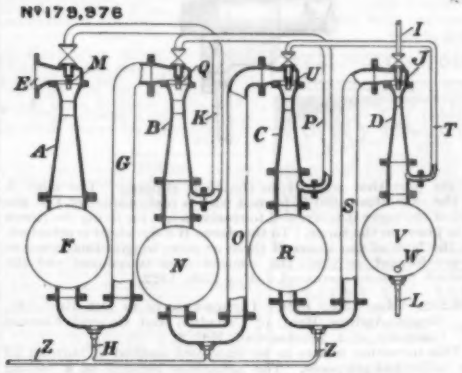
The whole is then placed in a mould, and an aluminium or other jacket D cast on to the conduit A. The core is then shaken out through the inlet and outlet openings B, which terminate in external bosses E upon the casting D. A composite jacketed conduit is thus provided with means for the admission and egress of heating media, such as the exhaust gases of the engine.—*May 25th*, 1922.

CONDENSERS.

179,976. January 12th, 1921.—IMPROVEMENTS RELATING TO MULTI-STAGE EJECTORS FOR WITHDRAWING THE AIR FROM SURFACE CONDENSERS, G. and J. Weir, Limited, Cathcart, Glasgow, and George Weir, of the same address.

In the drawing, A, B, C, D are the first, second, third and fourth ejectors respectively of a series. E is the suction port of the first-stage ejector. The discharge from this ejector passes into the inter-condenser F from which the air is led by the pipe G to the second-stage ejector, while the condensate is drained off by the pipes H and Z, the latter pipe being connected to the main condenser. A portion of the discharge of the second-stage ejector is withdrawn through the pipe K, and led to the first-stage ejector where, discharging through the nozzle M, it acts as aspirating or impelling fluid. The remainder of the discharge of the second-stage ejector passes into the inter-condenser N from which the air is led by the pipe O to the third-stage ejector, while the condensate is drained off by a pipe which discharges

Nº179,976



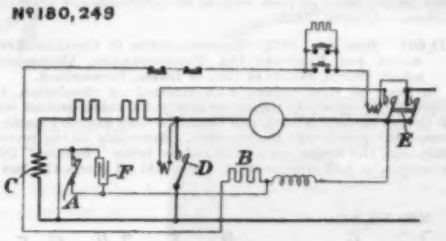
into the pipe Z. A portion of the discharge of the third-stage ejector is withdrawn through the pipe P, and led to the second-stage ejector, where, discharging through the nozzle Q, it acts as aspirating or impelling fluid. The remainder of the discharge of the third-stage ejector passes into the inter-condenser R, from which the air is led by the pipe S to the fourth-stage ejector, while the condensate is drained off by the pipe Z. A portion of the discharge of the fourth-stage ejector is withdrawn through the pipe T and led to the third-stage ejector, where, discharging through the nozzle U, it acts as aspirating or impelling fluid. The remainder of the discharge of the fourth-stage ejector passes into the condenser V, from which the air is delivered through the port W, while the condensate is drained off by a pipe L, which conveys it to the boiler feed tank. The nozzle J of the fourth-stage ejector is supplied through the pipe I with live steam.—*May 12th*, 1922.

SWITCHGEAR.

180,249. April 12th, 1921.—IMPROVEMENTS IN AND RELATING TO THE CONTROL OF ELECTRIC MOTORS, The British Thomson-Houston Company, of 83, Cannon-street, and Hammond Charles Hastings, of 235, Clifton-road, Rugby, and Harold Fitzhugh Farmer, of 32, York-street, Rugby.

A shunt motor of the variable-speed type is shown controlled by an automatic starter of the counter E.M.F. type, but this arrangement is shown for illustration purposes only, and the scheme can be applied to various other forms of automatic starters. A contactor A is arranged to short circuit the field rheostat B during the starting period. This contactor is controlled by a series coil C connected in such a manner that this coil is in circuit while the machine is starting, but is automatically cut out when a counter electromotive force contactor D closes and brings the machine up to full speed, so that when the line contactor E is closed the field contactor will also close, cutting

Nº180,249



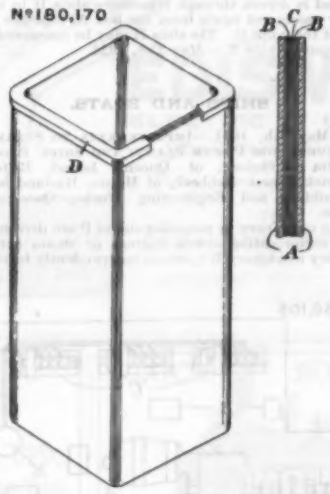
out the field rheostat and giving full field to the machine. This contactor will remain closed until the last accelerating contactor has operated, when the field contactor will be opened by reason of the short circuiting of its series coil C and will reintroduce into the shunt field circuit the field rheostat. The contacts of the field contactor are shunted by a condenser F to enable the contactor to open without excessive arcing, due to the voltage drop across the field rheostat.—*May 25th*, 1922.

BATTERIES.

180,170.—April 21st, 1921.—IMPROVEMENTS IN OR RELATING TO BOXES OR CONTAINERS, MORE ESPECIALLY INTENDED FOR ELECTRIC BATTERIES OR ACCUMULATORS, The New Eccles Rubber Works, Limited, of Monton-road, Eccles, Lancashire, and Sidney William Cox, of the same address.

The box or container is composed of two layers A, of ebonite or vulcanite, having layers or cores B of canvas separated by layers C of soft rubber interposed between the layers of ebonite

Nº180,170



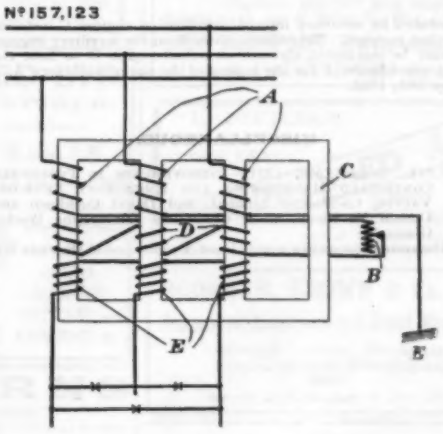
The top edges of the container are covered with a band or layer D of ebonite or vulcanite. The container is primarily intended for train lighting and other similar batteries, the usual outside wooden case being dispensed with.—*May 25th*, 1922.

TRANSFORMERS.

157,123. January 8th, 1921.—ARRANGEMENTS FOR THE SUPPRESSION OF EARTH LEAKAGE CURRENT OF HIGH-VOLTAGE NETWORKS, Siemens-Schuckertwerke Gesellschaft mit Beschränkter Haftung, of Siemensstadt, near Berlin.

This invention relates to the suppression of the earth leakage current of high-voltage systems. The neutral point of the primary winding of a transformer is connected directly to earth without the interposition of choking coils, and the delta connected secondary is so dimensioned or adjusted that when

Nº157,123



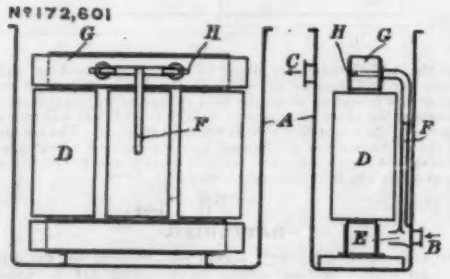
there is an earth leakage, the inductance opposing the earth leakage current is substantially smaller than the working inductance. The primary windings A of the transformer are star connected, and the neutral point is earthed at E. The secondary windings D are delta connected. By using an adjustable resistance B in the secondary winding, it is possible easily to adapt the transformer at all times to the variable conditions of the network. In order to obtain a compensating effect which shall be as strong as possible, it is preferable to provide a separate leg C, over which a portion of a flux passes, when

there is a short circuit. By adopting suitable dimensions, the E.M.F. in the coil connected to the conductor closed through earth, can in this way be made practically equal to zero, so that the full voltage of the network is obtained in the transformer. The same effect may also be obtained with a shell transformer. The transformer may be provided in addition to the secondary short-circuited compensation winding above referred to with an additional secondary, the windings E of which are star connected This additional secondary winding allows the transformer to be used for any other purpose, such as for lighting lamps or driving motors.—*May 8th*, 1922.

172,601. June 8th, 1921.—IMPROVEMENTS IN COOLING APPARATUS FOR ELECTRIC OIL TRANSFORMERS, Aktiengesellschaft Brown, Boveri et Cie., of Baden, Switzerland.

In large oil transformers with external oil circulation, the upper parts, especially the upper iron yoke, make contact with oil that is already heated, and therefore they are very liable to exceed the permissible temperature. According to the present invention, the upper yoke is cooled by being "washed" by a separate and cold stream of oil. The cold oil enters the box A

N°172,601



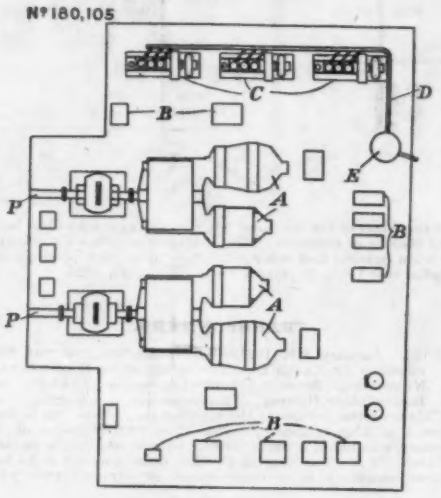
at the point B, and passes out of it in a heated state at the point C. The stream of cold oil is divided by a deflector at E into two portions, the greater portion spreading out at once in the lower part of the transformer box and then "washing" the transformer D from the bottom up to the top, whereas the other and far smaller portion flows through the pipe F directly to the upper yoke G, and is driven through transverse slots H in the yoke, and finally passes out again from the box A, together with the other oil, at the point C. The slots H may be connected directly with the separate pipe F.—*May 25th*, 1922.

SHIPS AND BOATS.

190,105. May 7th, 1921.—IMPROVEMENTS TO STEAM-DRIVEN MACHINERY FOR POWER PLANTS AND SHIPS' PROPULSION, Wilhelm Mickelsen, of Queen's Island, Belfast, and Frederick Ernest Rebbeck, of Messrs. Harland and Wolff Shipbuilding and Engineering Works, Queen's Island, Belfast.

The main machinery or propeller shafts P are driven as usual by either reciprocating steam engines or steam turbines A. The auxiliary machinery B is driven independently by electricity

N°180,105



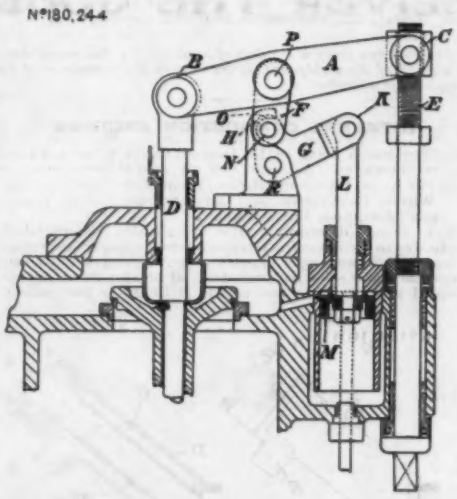
generated by auxiliary internal combustion engines C installed for that purpose. The exhaust gases from the auxiliary engines C may be conducted through an exhaust pipe D to heat the feed-water heater E for the boilers of the main machinery A.—*May 25th*, 1922.

MISCELLANEOUS.

180,244. August 5th, 1921.—IMPROVEMENTS IN POSITIVELY CONTROLLED MANŒUVRING AND EMERGENCY SHUT-OFF VALVES, Cockburns, Limited, and David Cockburn and Donald MacNicoll, all of Clydesdale Engineering Works, Glasgow.

The system comprises a main lever A connected at the ends B C respectively to the valve spindle D and to the valve-operating screw E, and fulcrumed about midway on a fulcrum link F. Fulcrumed on the valve casing is a bell-crank lever G, which is connected at its ends H K respectively to the fulcrum link F and to the rod L of an emergency piston M, designed to come into operation on the actuation of a control valve—not shown. The fulcrum link F and the adjacent arm of the bell-crank

N°180,244

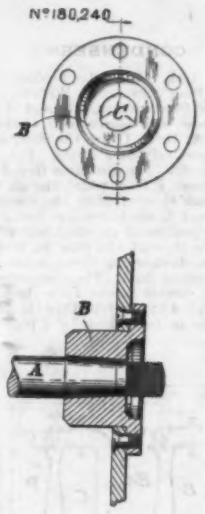


lever G present a toggle system, of which the central pivot N rests normally on a lug O disposed out of alignment with the fulcrum P of the main lever or levers and the fulcrum R of the bell-crank lever. When the emergency piston is operated, the toggle mechanism is first bent so that the pivot N disengages the lug O, and thus withdraws the fulcrum from the main levers A, and afterwards the bell-crank lever G acts on the link F to pull the main levers A towards the position in which the valve is closed.—*May 25th*, 1922.

180,240. July 13th, 1921.—IMPROVED MEANS FOR SECURING CAMS AND THE LIKE UPON TAPER SHAFTS, The Villiers Engineering Company, of Bakewall, Wolverhampton, and Frank Pountney, of 4, Mount-road, Penn, Staffordshire.

This invention relates to means for securing wheels, cams, &c., upon tapered shafts, and the object is to provide a simple arrangement which will avoid the use of feathers, pins, &c., and at the same time ensure a firm grip so that there is no danger

N°180,240

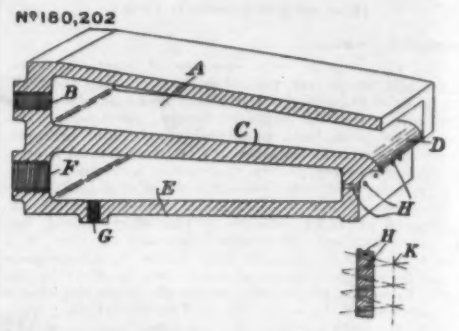


of the part that is fixed on the shaft slipping. The shaft A in the case illustrated is formed with a plain taper, and at the end of the taper it is screwed to receive a nut for fixing the sleeve B in place on the taper. To the sleeve B a fly-wheel is attached. In the bore of the sleeve B three or more longitudinal grooves C are formed, so that the contact area is reduced and the contact pressure increased.—*May 25th*, 1922.

180,202. May 13th, 1921.—IMPROVEMENTS IN OIL BURNERS, Ernest Andrew Reid, of Canadian and General Finance Company, of 3, London-wall, E.C. 2.

This invention relates to an improved method of burning oil for industrial purposes. The apparatus consists of a casting having an upper chamber A into which oil is supplied by a pipe through the opening B. The oil flows on to the downwardly inclined floor C and over the lip D, which is preferably curved as shown. Steam is introduced into the lower chamber E by a pipe through the opening F. G is an opening to receive a cock for removal of condensed water. The device is supported on two transverse ribs and in such manner that the floor C slopes downward at a suitable angle. The steam passes through the nozzles H, which are arranged to converge in pairs towards

N°180,202



points K, which are vertically beneath the edge of the lip D —*May 25th*, 1922.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

MONDAY, JULY 3RD.

THE ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, Piccadilly. General meeting. 5 p.m.

TUESDAY TO TUESDAY, JULY 4TH TO 11TH.

THE SOCIETY OF CHEMICAL INDUSTRY.—Glasgow. Annual general meeting. For programme see page 710.

WEDNESDAY, JULY 5TH.

THE INSTITUTION OF LOCOMOTIVE ENGINEERS: MANCHESTER CENTRE.—Visit to the works of the Partington Steel and Iron Company, Limited, Irlam, near Manchester. The directors of the company have courteously invited members to luncheon prior to the visit. It is suggested members travel by the 12.33 p.m. train from Manchester Central (C.L.C.) to Irlam, in order to be at the offices at 1 p.m.

THURSDAY, JULY 6TH.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Metropolitan District meeting at Ashby-de-la-Zouch. Members will leave St. Pancras at 10.20 a.m.

THURSDAY, FRIDAY AND SATURDAY, JULY 6TH, 7TH AND 8TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Scottish District meeting at Perth. For programme see page 733.

WEDNESDAY TO FRIDAY, SEPTEMBER 20TH TO 22ND.

THE INSTITUTE OF METALS.—Swansea. Annual autumn meeting.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE ATLAS METAL AND ALLOYS COMPANY (1921), Limited, informs us that it has removed its offices from 52, Queen Victoria-street, London, E.C. 4, to 1, Central-buildings, Westminster, London, S.W. 1, and requests that all communications may be sent to the new address. Telephone, Victoria 4426; telegraphic address, "Aloyau Vic. London."

WE are informed that a working arrangement has been arrived at between Sir W. G. Armstrong, Whitworth and Co., Limited, and the firm of Charles Walmsley and Co., Limited, paper-making machinery manufacturers, of Bury, Lancashire. The offices of the Armstrong-Whitworth Hydro-electric Department, No. 8, Great George-street, Westminster, S.W. 1, will be used as the London offices of Messrs. Walmsley and Co.

CONTRACTS.—Cammell Laird and Co., Limited, of Birkenhead have received an order from the United Fruit Company, of Boston, U.S.A., for three insulated motor ships for their fruit business. The vessels are of about 4000 tons gross and will be propelled by electric motors, the current being generated by "Camellaird-Fullagar" Diesel engines.

ROYAL AERONAUTICAL SOCIETY.—It is announced that the first associate fellowship examination of the Royal Aeronautical Society in accordance with the new regulations will be held on Monday, September 25th (Part I.), and Tuesday, September 26th (Part II.), in the Library at 7, Albemarle-street, London, W. 1. Entries should reach the secretary at that address not later than Monday, August 28th.

TRAIN RESISTANCE.—Some years ago, in certain experiments on train resistance tests were made of the effect of closing the spaces between vehicles so that the whole train presented a continuous exterior. Frequent references to these tests have appeared in THE ENGINEER, but we have failed to trace the details of them. These details are required by a correspondent, and we shall feel greatly obliged to any reader who can inform us where they are to be found.—ED. THE E.

END OF VOL. CXXXIII.

PATENTS

THE PROPRIETOR of LETTERS PATENT No. 129,000, relating to

SUCTION CLEANER,

DESIRES to DISPOSE of his PATENT or to GRANT LICENCES to interested parties on reasonable terms with a view to the adequate working of the patent in this country.—Inquiries to be addressed to

CRUIKSHANK and FAIRWEATHER,

65-66, Chancery-lane, London, W.C. 2. 8650 H

THE PROPRIETOR of PATENT No. 110,717, "Stern Tubes and their Stuffing-boxes," is DESIROUS of ENTERING into ARRANGEMENTS by way of LICENCE and otherwise on reasonable terms for the purpose of EXPLOITING the same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to J. E. EVANS-JACKSON and CO., Patent Agents, 57/60, Holborn-viaduct, London, E.C. 1. P5684 H

THE PROPRIETORS of LETTERS PATENT No. 109,340, relating to

MOTOR PLOUGHS,

DESIRE to DISPOSE of their PATENT or to GRANT LICENCES to interested parties on reasonable terms with a view to the adequate working of the patent in this country. Inquiries to be addressed to

CRUIKSHANK and FAIRWEATHER,

65-66, Chancery-lane, London, W.C. 2. 8522 H

THE PROPRIETOR of BRITISH PATENT No. 16,130/14, dated July 6, 1914, relating to "VACUUM CLEANER," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise on reasonable terms for the purpose of EXPLOITING the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. SINGER, Steger Building, Chicago, Illinois. 8599 H

THE PROPRIETORS of LETTERS PATENT No. 122,279, relating to "MEANS FOR INDICATING THE CORRECTIONS TO BE APPLIED FOR DEFLECTION OR ELEVATION WHEN FIRING AT MOVING TARGETS," DESIRE to DISPOSE of their PATENT or to GRANT LICENCES to interested parties on reasonable terms with a view to the adequate working of the patent in this country.—Inquiries to be addressed to

CRUIKSHANK and FAIRWEATHER,

65-66, Chancery-lane, London, W.C. 2. 8496 H

THE PROPRIETORS of BRITISH PATENT No. 122,119, dated 4th June, 1918, for "Improvements in or relating to Retort Charging Machines," are DESIROUS of ENTERING into NEGOTIATIONS for the EXPLOITATION of the invention in Great Britain.—For particulars apply, MEWBURN, ELLIS and CO., of 70/72, Chancery-lane, London, W.C. 2. P5647 H

TO MANUFACTURERS OF ORE ROASTING FURNACES.—The PROPRIETORS of PATENT No. 9958 of 1915 are DESIROUS of ENTERING into NEGOTIATIONS for the GRANT of LICENCES to manufacturers on royalty or otherwise or to treat for the SALE of the PATENT outright.—Particulars will be furnished on application by A. M and WM. CLARK, 52 and 54, Chancery-lane, London, W.C. 2. 8514 H

MACHINERY, &c., WANTED

WANTED, a Compound Condensing Vertical or Horizontal MILL STEAM ENGINE, moderate speed, 300 H.P. or near, steam pressure 100 lb. Must be in first-class condition. State age, lowest price and all other particulars to MASSON SCOTT and COMPANY, Ltd., Coronation Wharf, Townsend-road, Fulham, S.W. 6. P5304 F

WANTED, AMMONIA COMPRESSION REFRIGERATOR, minimum capacity 24 tons ice-making per 24 hours, steam or motor driven, steam pressure 100 lb. per sq. in. or voltage 220 D.C. State full particulars, price, makers, place of inspection.—Address, 8417, The Engineer Office. 8417 F

WANTED, LOCOMOTIVE (Tank Type), 4ft. 8½in. gauge, cyls. about 12in. dia.; must have jib crane to lift 2 tons. Must be in perfect condition. State price, maker, age, and where seen.—Address "LOCOMOTIVE," Wm. Porteous and Co., Advertising Agents, Glasgow. P5638 F

WANTED, STEEL BRIDGE, About 150ft. Long, 20ft. wide, and 14ft. high. Full particulars and price.—Address, 8633, The Engineer Office. 8633 F

WANTED, a 42in. or 54in. Bullard VERTICAL TURRET LATHE with side head. Give full particulars of condition, price, and where seen.—Address, 8609, The Engineer Office. 8609 F

WANTED, Second-hand Power-driven ANGLE BENDING MACHINE, to work 8ft. plates up to 16-gauge. Full particulars and state where can be seen.—Address, P5639, The Engineer Office. P5639 F

DYNAMOMETER, Hessan and Froude Type, Capable absorbing 50 to 100 B.H.P. at 1500 revs. p.m.—Address full particulars, P5630, The Engineer Office. P5630 F

HORIZONTAL COMPOUND STEAM ENGINE WANTED, cylinders about 16in. and 24in. dia. by 3ft. 6in. stroke, pressure 120 lb.—Reply, giving full particulars and price, to Box H., Messrs. W. H. Smith and Son, 53, Lichfield-street, Wolverhampton. P5644 F

LOCOMOTIVE, 2ft. Gauge, Baldwin, Side Tank, 4-6-0. Excellent condition. Price £260. Great bargain.—E. W. FARROW and SONS, Spalding. 8612 F

ONE Vertical "Vickers-Petters" SEMI-DIESEL OIL ENGINE, with driving pulley suitable for driving an air compressor requiring from 60 to 70 B.H.P. on crank shaft; compressor pulleys 36in. by 10½in. face (fast and loose), running at 340 r.p.m.—Address, 8647, The Engineer Office. 8647 F

SECOND-HAND STEAM CRANE REQUIRED, 3 or 5 tons lift, approx. 50ft. jib.—NORTONS (Tividale), Ltd., Tipton. 8586 F

FOR SALE

A LEADING LIST

OF NEW and SECOND-HAND MACHINERY can be obtained from W. H. PEASE and CO., Ltd., Hastings House, Norfolk-street, London.

TELEGRAMS: "ENGIPEASE, ESTRAND," LONDON.

SEE OUR ADVERT. ON PAGE XLII. OF LAST ISSUE

Ex.

BOILERS FOR SALE.—THREE High-class LANCASHIRE BOILERS, 30ft. by 9ft. (no cross tubes), 30ft. by 8ft. 9in. (no cross tubes), and 30ft. by 8ft. All complete with fittings and mountings ready for work and passed to re-insure at 100 lb. pressure. Prices right.—JOSEPH PUGSLEY and SONS, Ltd., Cattybrook Ironworks, Lawrence Hill, Bristol. 8614 G

DRILLING MACHINES.—About 40 Yorkshire Type, American type, &c., up to 42in. Also Radials.—MITCHELLS, Bolton. 8588 G

FOR SALE, First Quality SECOND-HAND SLEEPERS; main line, uncreosoted; good for sidings, cart roads, &c.—H. H. NEAL and CO., 52, The Broadway, Ealing, W. 5. Telephone, Ealing 1764. 7831 G

FOR SALE

FOR IMMEDIATE DISPOSAL, Triple-expansion ENGINE, 10in., 15½in. and 26in. by 18in. stroke, with Marine Type Return-tube BOILER, 10ft. by 10ft., dome, smoke and funnel, built to Lloyd's requirements for 180 lb. working pressure; can be purchased cheap owing to cancellation of contract.—Address P5448, The Engineer Office. P5448 G

FOR SALE at a Reasonable Price.—Complete COAL GAS PLANT, to manufacture 250,000 cubic feet per 24 hours, including four gasholders of respective capacities of 106,000, 94,000, 60,000, and 40,000 cubic feet. Complete WATER GAS PLANT, to generate 500,000 cubic feet per 24 hours, with relief holder, boilers, &c. Both plants are in first-class working condition and suitable for re-erection.—For list apply to Mr. W. J. GREY, Secretary, Alliance and Dublin Consumers' Gas Co., D'Olier-street, Dublin. 8530 G

FOR SALE, FOUR New and Unused High-class VERTICAL CROSS-TUBE BOILERS, each 11ft. by 4ft., 100 lb. pressure. Full sets of fittings and mountings, including feed pumps and injectors.—JOSEPH PUGSLEY and SONS, Ltd., Cattybrook Ironworks, Lawrence Hill, Bristol. 8615 G

FOR SALE, High-class GENERATING PLANT, comprising 140 K.W. Belliss-Lancashire Dynamo Combined Set, 440 volts D.C.; Three similar Sets, 75 K.W. each; Engines, equal cylinders, suitable 80 lb. pressure. Modern and in practically new condition, for delivery at once.—Address, 8623, The Engineer Office. 8623 G

FOR SALE, LARGE QUANTITY of BUILT-UP GIRDERS (suitable for bridges), H GIRDERS, ANGLES, STANCHIONS, FISH-PLATES, and PITCH PINE TIMBERS. Also Boilers, Economisers, Steel Chimneys, Engines, Motors, Tools and other Machinery. Inquiries solicited.—WARD BOILER SETTING ENGINEERS, Ltd., 1, Victoria-buildings, Manchester. P5653 G

FOR SALE, OIL ENGINE, by Gardner, 44 H.P., in good condition; price £35.—Apply, Bowde Rectory, Devizes. 8611 G

FOR SALE, ONE STEAM LOCO. TRAVELLING CRANE, suitable for steel works, to lift 6 tons at 7ft., 6in. and 2 tons at 25ft., radius, standard gauge, dead buffers; lying near Glasgow.—GEO. COHEN SONS and CO., 600, Commercial-road, E. 14. 8206 G

FOR SALE, Steam-driven HYDRAULIC PUMPING ENGINE, by Fielding and Platt; 3 steam cyls., 30in. dia. by 24in. stroke; rams, 3½in. dia.; pressure up to 2 tons per square inch.—NEW LONDON ELECTRON WORKS, Regents Dock, Limehouse, E. 14. 8597 G

FOR SALE, STEAM WINCHES (6), Clarke-Chapman, 6in. cyls. by 12in. strokes; immediate delivery; price £85 each.—J. T. WILLIAMS and SONS, South Bermondsey Station, London, S.E. 16. 8626 G

FOR SALE.—
ONE Practically New Wilkinson 9in. SLOTTING MACHINE, with balanced ram, overhead motion.
ONE Practically New 15in. CRANK SHAPER, by Centaur Tool Co., complete with vice and overhead motion.
ONE New 12½in. CENTRE LATHE, 10ft. 6in. gap bed, S.S.A.S. and S.C., complete with countershaft.
TWO 7in. Centre LATHES, 6ft. 2in. gap bed, S.S., S.A. and S.C. Makers, H. H. Ward.
ONE 36in. VERTICAL DRILLING MACHINE, to drill 12in., automatic and hand feeds, back geared.
TWO WALL RADIAL DRILLING MACHINES, by Rushworth and Co., length of arm from centre to rail 6ft. 6in., overhead motion.
ONE New Double-spindle DRILLING MACHINE, drills to centre of 16in., complete with countershaft.
ONE Improved Double-geared RADIAL DRILLING MACHINE, with arm approx. 5ft.
STANLEY ENGINEERING CO., Bath. Ex.

FOR SALE, the Largest Stock in the Country of Unused WROUGHT IRON SCREWED and SOCKETED PIPES, both brand new and ex-Army stocks, as follows:—
11,000 Feet, 8in. steam.
100,000 Feet, 6in. water.
135,000 Feet, 4in. water.
47,000 Feet, 3in. water.
15,000 Feet, 2in. water.
12,000 Feet, 2in. steam.
Also 5in., 14in., and 11in., 4in.
100,000 Feet of 4in. Solid-drawn Steel with loose flanges.
GEORGE COHEN SONS and CO., 600, Commercial-road, London, E. 8275 G

FOR SALE, THEODOLITES, DRAWING INSTRUMENTS, SECOND-HAND. CLARKSON'S, 252, High Holborn, W.C. (Opposite Gray's Inn-road). Ex.

FOR SALE, LEVELS, DRAWING INSTRUMENTS, SECOND-HAND. CLARKSON'S, 252, High Holborn, W.C. (Opposite Gray's Inn-road). Ex.

FOR SALE, TWENTY-FIVE RIVETED STEEL SETTLING TANKS, each 30ft. long by 10ft. wide by 2ft. deep, practically new; ONE RIVETED STEEL TANK, 30ft. by 10ft. by 4ft. 6in., with moulded bottom; and about 80 TONS of 6in. CAST IRON FLANGED PIPES.—JOSEPH PUGSLEY and SONS, Ltd., Cattybrook Ironworks, Lawrence Hill, Bristol. 8616 G

FOR SALE, TWO Belt-driven PUMPS, Rotary system with oscillating segment, capacity 200/600 and 400/2000 G.P.H. resp. What offers for quick disposal?—Write, W. E. HUGHES and CO., 50 and 51, Lime-street, E.C. 3. P5629 G

FOR SALE.—TWO GALLOWAY BOILERS, One 24ft. long by 6ft. 6in. diameter, passed for 150 lb. working pressure; price £300 f.o.r.
The other 24ft. long by 7ft. 6in. diameter, passed for a 200 lb. working pressure; price £350 f.o.r.
A number of fittings, including water level alarm, valves, &c., go with each boiler.
Full particulars and copies of insurance reports will be sent on application to CADBURY BROS., Ltd., Engineers' Office, Bournville. 8550 G

FOR SALE, 2 LANCASHIRE BOILERS, by Danks, 30ft. long by 7ft. dia., fitted with superheater, 1920, insured for 160 lb. pressure. Can be seen fixed.—WILLIAMS, 37, Queen Victoria-street, London. 8498 G

FOR SALE, 4 Nearly New Taylor and Challen Geared PRESSES, 18in. stroke, 42in. between standards, 14in. hole in bed, pressure exerted 1000 tons.—Apply, GEORGE COHEN, SONS and CO., 600, Commercial-road, London, E. 14. 8484 G

FOR SALE, 30in. CIRCULAR COLD SAW MACHINE, by Chambers, Scott and Co., 5ft. 3in. by 3ft. 14in. wide table. Fine machine, scarcely used, and others.—Address, 8549, The Engineer Office. 8549 G

FOR SALE, 400 K.W. Belliss TRIPLE-EXPANSION ENGINE, direct coupled to Crompton DYNAMO, 440 volts D.C. Can be seen fixed. Cheap, immediate removal.—WILLIAMS and SONS, 37, Queen Victoria-street, London. 8638 G

FOR SALE, 240 K.W. Belliss and Morcom COMPOUND ENGINE, direct coupled to Multipolar Crompton's GENERATOR, 440/550 volts, 350 r.p.m., and fitted with Ejector Ledward's Condenser. Can be seen fixed working.—WILLIAMS, 37, Queen Victoria-street, London. 8497 G

FOR SALE, 1000 K.W. Belliss-Siemens A.C. SET; Triple-expansion Engine coupled to single-phase, 2200 volts Alternator.—Address, 8639, The Engineer Office. 8639 G

For continuation of For Sale Advertisements, see page iv.

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Precision is the watchword of all engineers. Near enough is not good enough. The job is either within the limits or it is not. So with the lighting of your shop, unless it conforms to the standards of illuminating engineers, you can be quite sure you are losing output.

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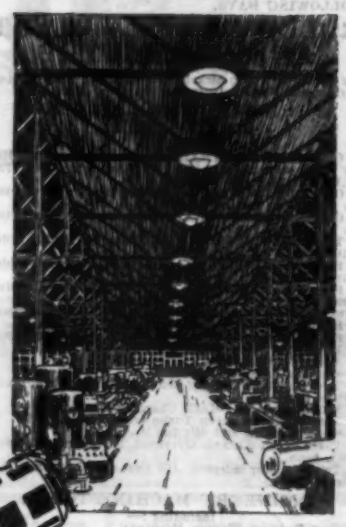
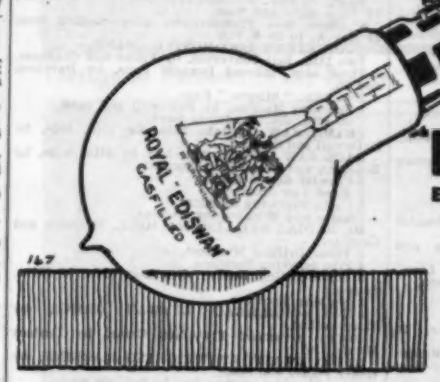
Catalogue GG 212 on request.





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370 tons F.B.
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Every description of pattern made with systematic method and modern machinery.
Accurate Work at Competitive Prices.
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CASTINGS.
Modern Foundry equipped for weights up to 10 or 12 tons. Keen prices. Best quality.
(See also display machine tool advertisement June 23rd.)
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MOST MODERN "DISH-END" TYPE
WITH CORRUGATED SECTIONS.

1	30ft. by 9ft. 3in.	by 150 lbs. w.p.	Shop No. 5764
11	30ft. by 9ft. 3in.	by 160 lbs. w.p.	Shop No. 6749-53 & 5994-9
3	32ft. by 9ft. 3in.	by 120 lbs. w.p.	Shop No. 6019-20 & 6027
3	30ft. by 8ft. 6in.	by 120 lbs. w.p.	Shop No. 6017-8 & 6026
1	30ft. by 8ft. 3in.	by 175 lbs. w.p.	Shop No. 5994
2	30ft. by 8ft. 3in.	by 160 lbs. w.p.	Shop No. 6023-9
1	30ft. by 8ft. 3in.	by 180 lbs. w.p.	Shop No. 6025
4	30ft. by 8ft. 3in.	by 150 lbs. w.p.	Shop No. 5812-5 & 5670
1	30ft. by 7ft. 6in.	by 180 lbs. w.p.	Shop No. 5967
3	28ft. by 7ft. 6in.	by 180 lbs. w.p.	Shop No. 5792/4

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Repairs to all type of Boilers by First-class Men.
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118, Queen Victoria St., London, E.C.4.
COMPRESSED AIR
HOSES, VALVES, COCKS, and all Kinds of Fittings.

REDPATH, BROWN & Co., Ltd.
Structural Engineers and Steel Merchants
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Better and more economical Tools
Write for List N°26
A.A. JONES & SHIPMAN Ltd. LEICESTER

AUCTIONS

Fuller, Horsey & Co.'s Advertisements

Continued from c.

G. R.

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At the GOVERNMENT ROLLING MILLS, SOUTHAMPTON.

Messrs.

Fuller, Horsey, Sons and Cassell

will SELL by AUCTION, in Lots, on the PREMISES, on TUESDAY, 25th JULY, 1922, and FOLLOWING DAYS,

ROLLING MILL PLANT AND MACHINERY,

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14 ELECTRICALLY-DRIVEN ROLLING MILLS,

as under :

ONE FIVE-SET TRAIN, by Robinson, 24in. dia. by 48in. wide to 20in. dia. by 30in. wide, with 750 H.P. A.C. Motor, by B.T.H.

ONE EIGHT-SET TRAIN, 20in. dia. by 30in. wide to 18in. dia., 20in. wide.

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THREE TWO-SET TRAINS, 12in. dia., 12in. wide, with B.T.H. 50 H.P. Motors.

EIGHT TWO-SET TRAINS, 8in. dia., 8in. wide, with B.T.H. 40 H.P. Motors.

Forty-four Taylor and Challen Cutting and Cupping Presses.

Six Sutcliffe-Speakman " Emperor " Forging Presses.

Eighty-two Wright 240 lb. Crucible Furnaces.

Fifty-six Wright 600 lb. Tilting Crucible Furnaces.

Hydraulic Scrap Press.

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Two Buckton Shearing Machines, Tangye Hydraulic Wheel Press.

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Reavell Motor-driven Turbo Compressors.

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Three 5-Ton Electric Overhead Travellers, 68ft. and 80ft. span.

Two Appleby Electric Jib Cranes. Grafton 5-Ton Steam Crane.

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Two Stirk 16in. Screw-cutting Lathes.

Ten Screw-cutting and Capstan Lathes, various.

Campbells and Hunter 14in. Slotting Machine.

Kearn No. 2 Horizontal Boring and Facing Machine.

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MISCELLANEOUS PLANT,

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Mason Stone Crusher, Mortar Mills, 36in. Circular Saw Bench.

24in. Band Saw Scrap Metal Conveyors and Elevators.

Maaning-Wardle 3½in. Standard Gauge Loco., Narrow-gauge Track, 24in. Gauge Side-tip Wagons.

ELECTRIC POWER PLANT,

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THIRTY 3-PHASE MOTORS, 440 volts, 50 periods, up to 50 horse-power.

May be viewed by orders to be obtained of Messrs. FULLER, HORSEY and CO., Mechanical Auctioneers and Valuers, 11, Billiter-square, London, E.C. 3.

8607 I

G. R.

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PLANT & MACHINERY,

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On TUESDAY and WEDNESDAY, JULY 11TH and 12TH,

At 11 a.m. each day, comprising :

11 MOTOR GENERATORS, 10, 24 and 30 K.W.; 73 SINGER'S SEWING and DARNING MACHINES; 10 ROTARY WASHING MACHINES and HYDROS; 130 PORTABLE AIR COMPRESSORS, by Reavell and Co., Ipswich; VERTICAL BOILER, 4ft. 3in. by 11ft. 3in. high; 2 TELEGRAPH DUPLEX SETS with RELAYS; 884 WIRELESS INSTRUMENTS; 400 TELEPHONE SETS; 330 D.H. TELEPHONE RECEIVERS; 50 TELEPHONE EXCHANGE BOARDS; 4 WATCHMAKERS' LATHES; 2560 Buzzer Unit Instruments; 20,000 Double Hook Insulators; 180,000 Telegraph Bolts and Insulators; 2000 Battery Boxes, Switchboards, Cable Reels, Telephone Screens, Galvanometers; 24,000 Miles of Telephone Cable; 500 K.W. TURBINE GENERATING SET, 230 volts, 2200 amps., complete with Condensing Plant and Switchboard; 17-TON WAGON HOIST and TIPPING TRAY CONVEYOR; CLINKER CONVEYOR; STEAM-DRIVEN HYDRAULIC PUMP; 28 OVERHEAD CRANES, jib and cross traverse, 6ft. 9in., 16ft. 6in., 47ft. 8in. spans; Fans, Signal Lamps; 198 Wagons, Limbers and Carts; 1166 Floor Trucks; Telegraph Poles, Insulated Copper Cable, Ebonite Insulators; 6 Electric Searchlights on Carriages; 4 Howitzer Mountings on Rail Trucks; Semi-rotary Pumps, Well Pumps, Hose Piping, Spanners, Road Scrapers, Road Jumpers, Dog Spikes, Sawyers' Dogs, Oxygenite, Petrol Cylinders, Pistons and Spare Parts, Microphone Capsules; NATURAL DRAUGHT COOLING TOWER, 70ft. high, capacity 312,000 gallons of water per hour from 95 to 80 deg. Fah.; 2 VERTICAL DIRECT-ACTING BOILER FEED PUMPS, capacity 6000 gallons per hour against 160 lb. per square inch.

On view by catalogue only, Thursday, Friday and Monday, July 6th to 10th, from Ten to Five o'clock.

Catalogues (2s. each) may be had, when ready, on application to the Auctioneers, Messrs.

Eadon and Lockwood, F.A.I.,

2, 7 St. James'-street, Sheffield; or from the Auctioneers' Offices at the Central Ordnance Depot, Chilwell, Notts. Telephones, Central 111 and 1277 Sheffield. Telegrams, " Weedon, Sheffield." 8509

PRELIMINARY ANNOUNCEMENT.

ST. MELLONS, MON. (about midway between Newport and Cardiff).—VERY IMPORTANT SALE OF CONTRACTORS' PLANT, &c.—By Direction of the Rhymney Valley Sewerage Board.—Mr.

Charles D. Phillips,

Machinery, Plant and Contractors' Auctioneer, will SELL, by AUCTION, at an EARLY DATE, the whole of the valuable

CONTRACTORS' PLANT,

STORES, &c.,

including :—

2-Ton and 3-Ton Steam Travelling Cranes, 30-Cwt. Derrick Crane, 20 H.P. Portable Engine, 5-Ton Steam Wagon and Trailers, Concrete Mixers, Vertical Boiler, 2ft. gauge Loco., " Priestman " Grabs, Pumps, Saw Bench, Water Cart, Tanks, Theodolite, Level and Staff, Forges, Anvils, Pipe Laying Gantry, Pile Drivers, 7000 c. ft. P.P. Baulks and other Timber, Several Huts, Sheds and Wooden Buildings, Large Quantity F.B. Rails, Sleepers, Railway Plant, &c., Skips, Tools, Small Plant, Stores and numerous other items.

Further particulars in future announcements.

Catalogues (when ready) obtainable from J. S. Alford, Esq., M. Inst. C.E., 11, Victoria-street, Westminster, S.W. 1; D. J. Treasure, Esq., Solicitor, Pessaya, Mon.; or the AUCTIONEER, Austin Friars Chambers, Newport, Mon. 8591 I

AUCTIONS

Wheatley Kirk, Price & Co.'s Advertisements

Continued from c.

G. R.

BY DIRECTION OF THE DISPOSAL BOARD.

SALE BY PUBLIC AUCTION

in Lots of

BOILER-HOUSE PLANT, WOODWORKING MACHINERY, ELECTRICAL PLANT, MOTOR VEHICLES, MACHINE TOOLS, STOCK AND STORES,

At H.M. FACTORY, GRETNA, DUMFRIESSHIRE,

On TUESDAY, WEDNESDAY, THURSDAY and FRIDAY, JULY 18TH, 19TH, 20TH and 21ST,

Commencing at Eleven o'clock prompt each day, including :—

23 LANCASHIRE BOILERS, 30ft. long by 8ft. dia., by Galloways Ltd. Yates and Thom, and other makers.

1 COCHRAN VERTICAL BOILER, 6ft. 6in. dia. by 14ft. high.

5 SUPERHEATERS, by T. Sugden, Ltd.

6 GREEN'S FUEL ECONOMISERS.

24 Pairs Mechanical Stokers, by J. Hodgkinson, Ltd.

28 Bucket Coal Elevators, by Bennis and Co., Ltd., and Fraser and Chalmers.

9 SETS WORM REDUCTION GEARS, by Henry Wallwork and Co., Ltd.

TWO 120 K.W. STEAM GENERATING SETS.

70 SLIP RING and SQUIRREL CAGE MOTORS, all 50 periods, sizes ranging from 1 H.P. to 250 H.P.

Horizontal Steam Engine, 16in. cylinder by 16in. stroke.

40 B.H.P. Vertical Steam Engine, by Robey and Co., Ltd.

5 DIRECT-ACTING BOILER FEED PUMPS, by G. and J. Weir, Ltd.

Steam Capstan, 6in. dia. cylinders by 6½in. stroke, by Thos. Reid and Sons.

8 Three-phase Transformers, sizes ranging from 2½ K.V.A. to 25 K.V.A.

7-TON STEAM LOCOMOTIVE CRANE.

Two 18in. Belt Conveyors, by Fraser and Chalmers.

Three 55in. Induced Draught Fans, by Davidson and Co.

Two 20in. " Sirocco " Fans.

1 Tenoning Machine, by McDowall and Sons.

Two 26in. dia. Pendulum Saws.

FRAME SAW, to take 21in. by 21in. logs, by McDowall and Sons.

RACK SAW BENCH, 60ft. long by 31in. wide, by Robinson and Sons, Ltd., Rochdale.

2 Circular Saw Benches.

3 Band Saw Machines.

3 Chain Morticing Machines.

Planing and Thicknessing Machine.

4ft. RADIAL DRILLING MACHINE, by Smith and Coventry.

7 Pillar Drilling Machines.

4 Pipe Screwing Machines.

6 Screw-cutting Lathes, sizes from 3½in. to 10½in. centres.

2 Shaping Machines.

3-TON OVERHEAD RUNWAY CRANE, by Tangyes Ltd.

10-Cwt. Overhead Travelling Crane, by Herbert Morris, Ltd.

12-TON PLATFORM WEIGHING MACHINE, by Henry Pooley and Sons.

2 Double-purchase Winches, by Fellows Bros.

10-Cwt. Platform Weighing Machine, by W. and T. Avery, Ltd.

ONE 10-12-TON STANDARD TRUCK TIPPLER, by Fraser and Chalmers.

2 STACKER and LOADERS with Telescopic Ends.

250 H.P. MOTOR-DRIVEN CENTRIFUGAL PUMP, by Mather and Platt.

10 Duplex Pumps, 6in. by 5in. by 6in.

50 Small Centrifugal Pumps.

Concrete Mixer.

2 FIRELESS LOCOMOTIVES.

14 MOTOR CARS, LORRIES and VANS.

1 Enfield 3 H.P. Motor Cycle.

Quantity of Steel Piping from 6in. to 16in. dia, Hopkinson's Valves, from 1in. to 16in. dia.

Steel Shafting.

Quantity of Electric Cable, Stores, Instruments, &c., &c.

17 RAILWAY CARRIAGES.

NUMEROUS SPARE PARTS for MOTOR VEHICLES.

Oil Gas Generating Plant, 500 cubic feet capacity.

40-Tons Railway Weighbridge.

5 Signal Cabins.

On view one week prior to sale and each morning of sale before selling commences.

For catalogues and any further information apply to the Disposals Board Officer at the Factory, or the Auctioneers, Messrs.

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26, Collingwood-street, Newcastle-upon-Tyne; 48, Watling-street, London, E.C. 4; and 16, Albert-square, Manchester.

Registered telegraphic addresses : " Indicator, Newcastle-upon-Tyne," " Indices, Cent., London," " Indicator, Manchester." Telephones : 3220 Central (Newcastle-upon-Tyne), 5077 Bank (London), 3218 Central (Manchester). 8581 I

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SALE OF HIGH-CLASS

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comprising :—

GAS MUFFLE FURNACE, SPINDLE LENS POLISHING MACHINES, SPINDLE SENSITIVE DRILLING MACHINES.

14 CAPSTAN and S.C. LATHES.

Quantity of lathe tools, lens polishing tools, emery grinding, polishing, and edging machines, collimator, and telescope.

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A " FLEUSS " VACUUM PUMP, GLASS ROUGHING MACHINES.

THREAD and PROFILE MILLING MACHINES.

OXY-ACETYLENE WELDING PLANT.

Electric fans, oil filters, engineers' scientific instruments, 50 new filament electric lamps, iron brazing hearth, quantity of 2in. steel shafting, plummer blocks, pulleys, belting and wall brackets, galvanised iron belt guards, together with

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Engineers' benches, quantity of BRASS CASTINGS, SCRAP IRON and STEEL FORGINGS, vices, and a considerable quantity of dies, taps, drills, emery wheels, files, and complete equipment of optical works.

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Waite and Waite

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The Company makes the Nat Torbinia Semi-Diesel Type Oil Engine, both marine and stationary; 225 of such engines are at present in use.

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HYDRAULIC ACCUMULATOR, by Fielding and Platt, 17in. ram, 18ft. stroke, 1 ton per square inch.

DITTO, 14in. ram, 7ft. stroke, 800 lb. pressure.

DITTO, 6in. ram, 10ft. stroke, 1300 lb. pressure.

HORIZONTAL GEARED PUMPS, rams 3½in. dia. by 13in. stroke 3000 lb. per square inch 90 gallons per minute.

400-TON FORGING PRESS, 24in. ram by 30in. stroke, with jack rams.

340-TON DITTO, 18in. ram by 60in. stroke, with jack rams.

200-TON DITTO, 12in. ram by 36in. stroke, with jack rams.

Full specification and drawings upon application.

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LATEST TYPE 84 H.P. STOCKPORT GAS ENGINE, electric lighting type; also 80 H.P. DITTO. Excellent engine.—HARRY H. GARDAM and CO., Limited, Staines. 8618 G

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UNIVERSAL MILLERS.

EIGHT IN STOCK, 4CIN. BY 12IN. TO 60IN. BY 15IN. TABLES. ALL-GEARED HEADS AND OTHERWISE.

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3FT. 6IN., 5FT. AND 6FT. ARM, ALL TYPES AND PRICES, BOTH NEW AND USED.

TOOL AND CUTTER GRINDERS.

EIGHT IN STOCK.

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LATEST TYPE ALL-STEEL BODY, 1IN. CAPACITY, DOUBLE ENDED.

SHAPING MACHINES.

12IN., 16IN., 18IN. AND 26IN. MODELS.

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ONE 40IN. NEW ALL-GEARED DRIVE IN STOCK AND ONE 100IN. MACHINE IN TRANSIT.

HORIZONTAL BORING & DRILLING MACHINES.

FOUR 3IN. SPINDLE AND FIVE 2IN. SPINDLE, MODERN NEW ALL-GEARED DRIVE. STOCK.

UNIVERSAL AND PLAIN GRINDERS.

ALL SIZES FROM 10IN. BY 40IN. TO 15IN. TO 72IN.

CAPSTAN LATHES.

ALL SIZES. COME AND PICK THEM.

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MAGNIFICENT 700 I.H.P. HORIZONTAL CORLISS VALVE CONDENSING STEAM ENGINE, by Hick-Hargreaves, rope fly-wheel, jet condenser; new 1911.—Full details, HARRY H. GARDAM and CO., Ltd., Staines. 8624 G

FOR SALE, 500 H.P. Willans Geared-driven TURBO-GENERATOR, 500 volts D.C., all fitting as new fixed working.—WILLIAMS, 37, Queen Victoria-street, London. 8499 G

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TWO THREE-THROW, 9½ Rams, Lee-Howl Manufacture, complete with 230-volt Motors and Electrical Equipment.—INSULAR TRADING CO., Ltd., Douglas, I.O.M. 8416 G

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10ft. by 3ft. 8in. by 3ft. 8in., by Ambler and Dickinson; two tool-boxes on cross slide, single-belt drive.

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8ft. by 2ft. by 2ft., by Butler Machine Co.; one tool-box on cross slide, double-belt drive.

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6ft. by 2ft. by 2ft., by Redman Bros. (nearly new); two tool-boxes on cross slides, double-belt drive.

The above are all fitted with T-slotted tables and are all here in stock.

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SEMI-ENCLOSED 5 H.P., 200 Volts, 800 R.P.M., Shunt-wound, 4-pole D.C. MOTOR, in excellent condition, fitted with 7in. dia. by 5in. face pulley on slide rail bed plate with starter and H.P. indicator, also shafting, pulleys, &c.—Write, Box 1647, Willing's 30, King-street, Covent Garden, W.C. 2. 8580 G

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FOR SALE.

THREE LANCASHIRE BOILERS, 30ft. by 7ft. 6in., now insured at 150 lb. pressure.

TWO CORNISH BOILERS, 28ft. by 6ft. diameter, re-insure 90 lb. pressure.

EIGHT Good Second-hand Single-ended Three-furnace MARINE BOILERS, 10ft. 2in. long by 10ft. 3in. diameter, Fox's patent furnaces, re-insurable at 145 lb. per sq. inch working pressure.

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TWO New LOCOMOTIVE TYPE BOILERS, each about 4ft. 6in. long with barrel 2ft. 6in. long by 23 3-8in. diameter, suitable for a working pressure of 200 lb. per square inch. Makers, Marshall and Sons, Gainsborough. Suitable for road locomotion.

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16IN. LOCO., Six Wheels Coupled, 160 lb. Pressure

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12in. LOCO., six wheels coupled, 160 lb. pressure.

10-Ton STEAM CRANE, by Smiths.

2ft. Gauge PETROL TRACTOR.

WHEELS and AXLES, 6ft. 8in. centres, 8in. journals.

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40 K.W. Six-cylinder Parson Oil-driven GENERATING SET, 500 volts D.C., all accessories and panels. Also THREE 24 K.W. Three-cylinder SETS. Details.—HARRY H. GARDAM and CO., Limited, Staines. 8622 G

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60 TONS Nearly New CAST IRON FLANGE PIPES, mostly 9ft. lengths, 4in. diameter; £7 per ton f.o.r. Swindon.—KINGS, Garston, Liverpool. 8646 G

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70 H.P. Robey CRUDE OIL ENGINE. Perfect; £350.—CHICK, 8kin Market-place, Southwark, S.E. P5631 G

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110 H.P. CROSSLEY GAS ENGINE and OPEN-HEARTH GAS PLANT. Low price.—CHICK, 8kin Market-place, Southwark, S.E. P5632 G

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300 H.P. VERTICAL TRIPLE-EXPANSION ENGINE, by Bellis; also SIX COMPOUND ENGINES, 125 H.P. each, by same makers.—HARRY H. GARDAM and CO., Limited, Staines. 8626 G

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WANTED to MANUFACTURE, SPECIAL MACHINERY or ENGINEERS' APPLIANCES. Up-to-date machine plant for either heavy or medium work. Own foundry and pattern shop.—EASTON and JOHNSON, Ltd., Engineers, Taunton. Ex.

CASTINGS (IRON).—ORDERS WANTED for any weight and size (Yorkshire district), machined if necessary.—Address, 7832, The Engineer Office. 7832 I

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Half the Cost. Double the Output. Write for Folder.

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COMPETITIVE PRICES.

GOOD CLASS WORK. PROMPT DELIVERY.

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Desires Manufacturing and Selling Rights for U.S.A. on Royalty Basis—for Machinery Patented in U.S.A.

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IRON CASTINGS up to 3 tons.

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IRON CASTINGS (up to 15 tons each)

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Machine Moulded Gear Wheels up to 10ft. dia.

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GEARING OF ALL DESCRIPTIONS.

Enquiries invited from Engineers and other users.

CLAYTON, GOODFELLOW & Co. Ltd., Engineers & Ironfounders, Atlas Works, Blackburn.

For continuation of Work Wanted Advertisements see page viii.

FOR WHOLE TIME PRODUCTION.

THIS Portable Electric Drill has been specially designed for long and continuous use. By means of a fan mounted on the armature shaft, a stream of cool air is constantly drawn through the motor, thus enabling the machine to be kept in use for long periods without overheating.

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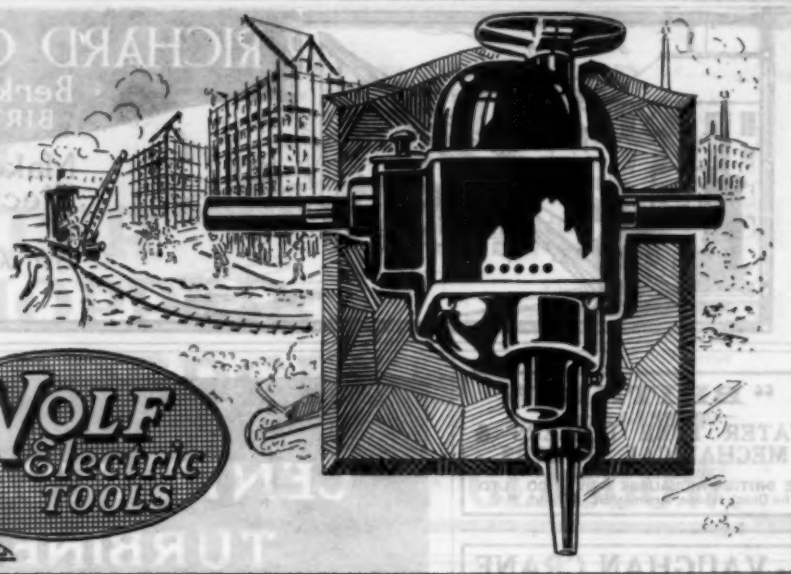

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Engineers & Contractors for all types of Structural Work in
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Corrugated Furnaces to any Survey. Morison, Fox and Deighton Sections.

The Strongest Pressed Steel Tank on the Market. 15,000 Tons Supplied.

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A belt that slips generates heat, and this heat dries out the belt and plays havoc with its pliability and power to grip. The immediate and effective cure—simples in application—is Foliac Solid Belt Dressing It gives you the last ounce of "pull." 2/3 per 1 lb bar, 24 bars in a case. Get a bar from your dealer—or direct, carriage paid.

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Eliminate Machining Costs
Ensure Interchangeability without gauging.
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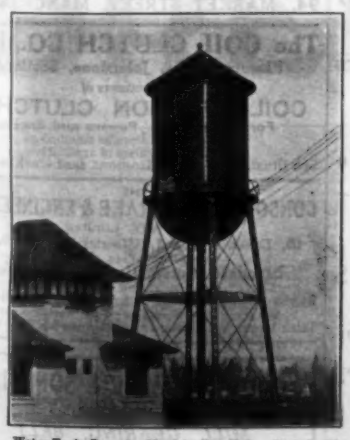

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One application of "BITUMASTIC" (REGD)
lasts 8 Years on water tank.

Mr. Fred L. Macpherson, Department of Public Works, Victoria, B.C., included the following in a letter to Messrs. Wailes Dove Bitumastic Ltd.:—

"While Municipal Engineer of Burnaby, British Columbia, your "Bitumastic," on the recommendation of Canadian Pacific Railway officials, was used to repaint two or three large Water Storage Tanks built on Steel Piers, and also for repainting large Steel Pipes being lifted and relaid. The work was done by Day Labour, and the results were much greater than our best expectations. The Water Tanks, which on erection three or four years previously had been treated with some other recommended preparation, showed considerable signs of rusting. The effects of the "Bitumastic" treatment was remarkable in contrast. I saw these tanks after about eight years in use, and the surface was still unimpaired. In preserving water mains the very best results were produced."

"Bitumastic" Solution is supplied ready for application in the same way as ordinary paint—in
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Wailes Dove Bitumastic Ltd.
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RICHARD C. GIBBINS & Co.
Berkley Street.
BIRMINGHAM.
Makers of Steam Electric & Hand Cranes.
All kinds of Lifting Tackle

"BRITNIC"
—4,000,000 H.P. in service—
WATER TUBE BOILERS & MECHANICAL STOKERS.
200,000 H.P. in service.
THE BRITISH NICLAUSSE BOILER CO., LTD.
The Clock House, Arundel St., Strand, W.C.

The VAUGHAN CRANE Co., Ltd.,
MANCHESTER.
Travelling Cranes—Runways—Pulley Blocks.

USE
'EMPIRE' AUTOMATIC CONTROL GEAR.
See Display Advt., page 94, June 23.
ELECTRIC CONTROL LIMITED
GLASGOW.

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Albion Works, GOVAN, GLASGOW.
Makers of
HIGH-CLASS MACHINE TOOLS
Specialities: Harvey Studders and Facers.
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Makers of
HEAVY SOLID-WELDED STEEL ANGLE RINGS, up to 6in. × 6in. × 1¼in., for Condensers, Boilers, &c.
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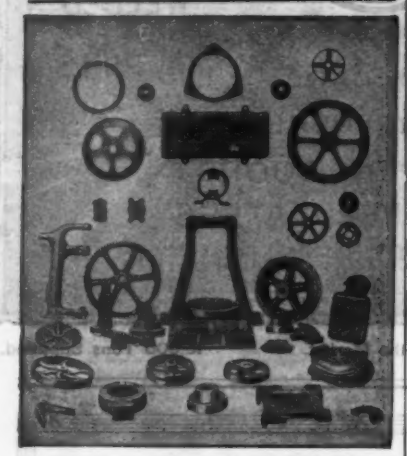

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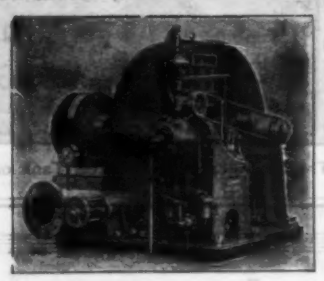

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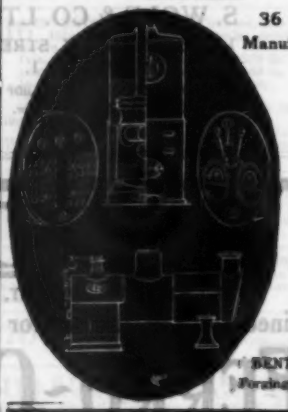

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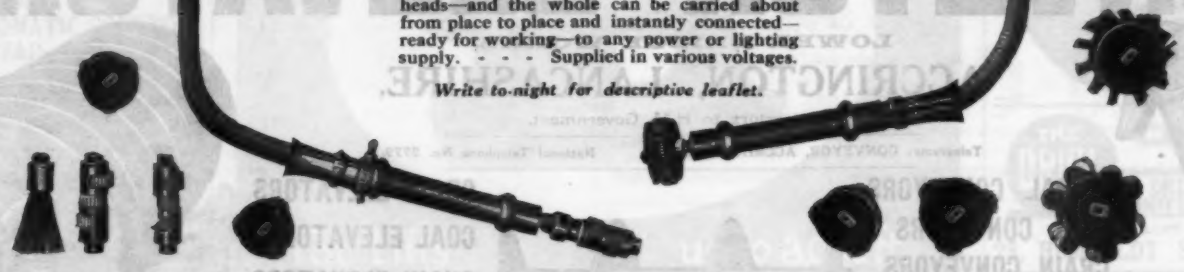

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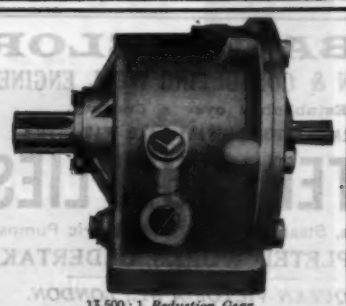

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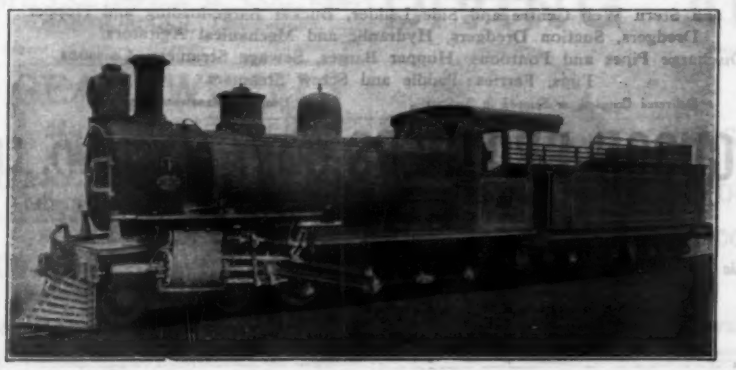

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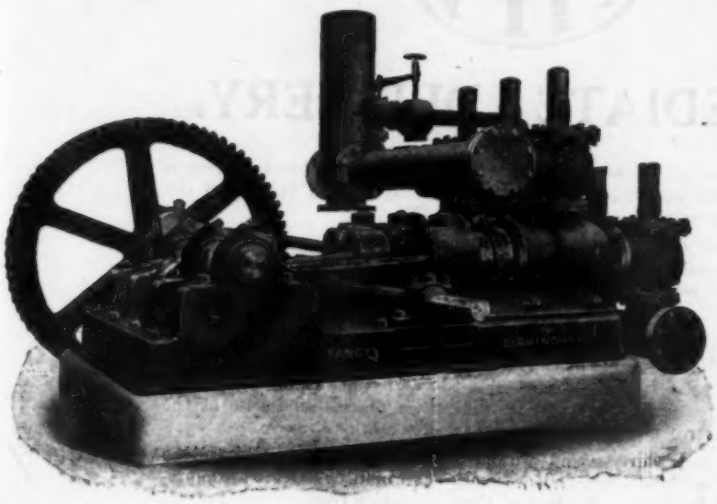

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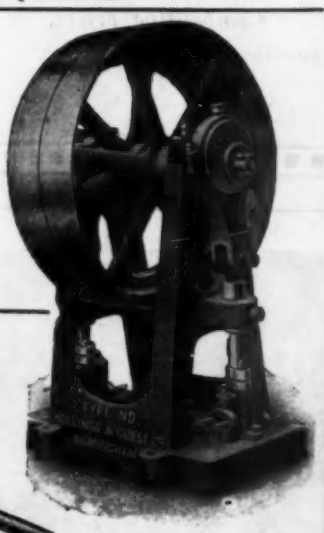
Hydraulic Pumps.

NEW DESIGN.

THE photo shows a set of Standard Hydraulic Pumps, two-throw. The tight pulley is a heavy flywheel, and the bearings are of gun-metal. The shaft is of mild steel, and the bodies and valves are of hydraulic gun-metal. The stand and uprights are all cast in one piece.



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Hand Hydraulic Pump.

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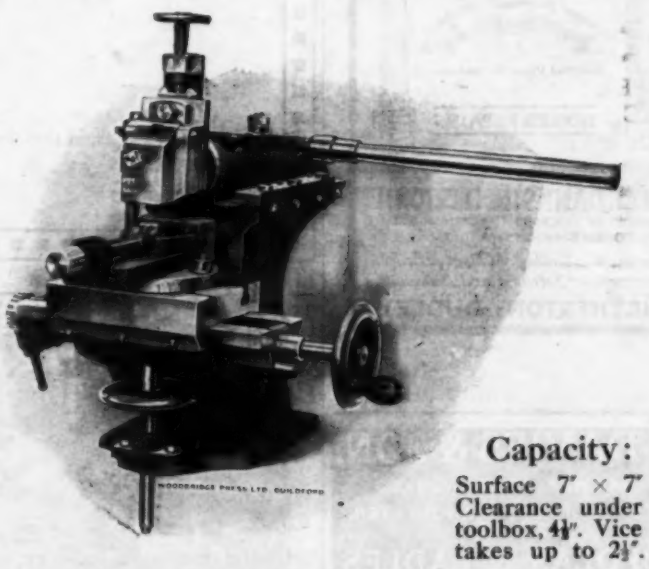

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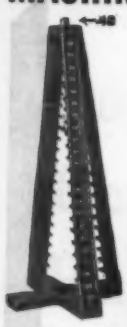

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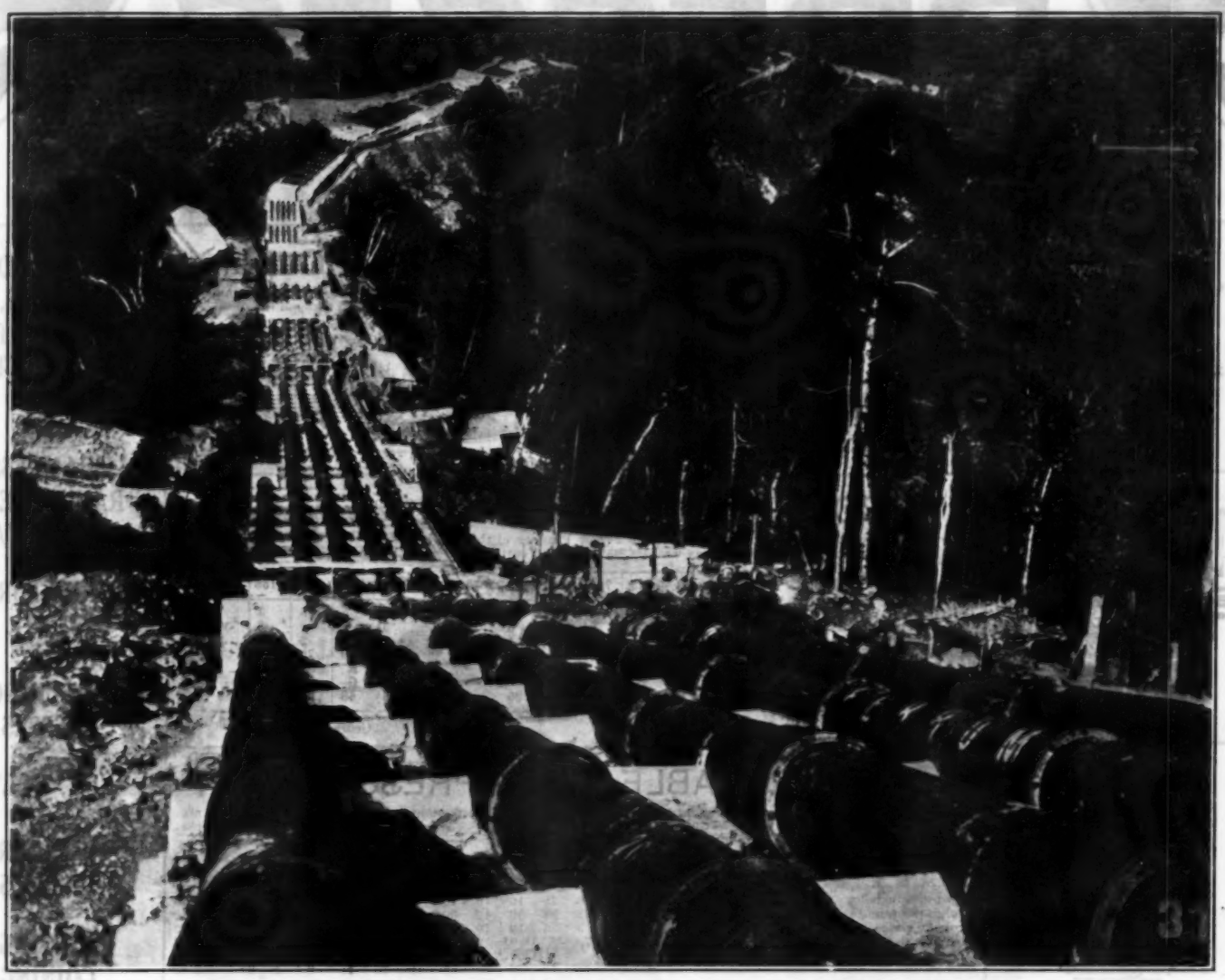

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SANTOS.

NUMBER OF PIPE LINES.	LENGTH OF EACH PIPE LINE IN FEET.	LARGEST & SMALLEST DIAMETERS IN INCHES.	HEAD IN FEET.	TYPE OF JOINT.
5	6600	37" / 25"	2100	FERRUM PATENT JOINT B.

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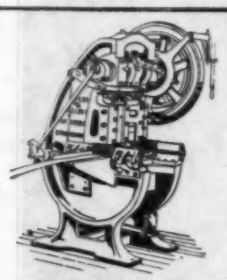
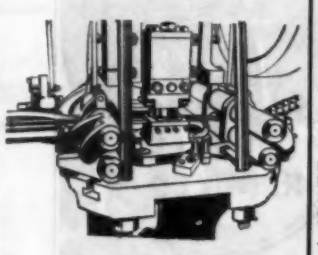


ROLLER FEED PRESSES—Cutting & Cupping.

The cutting punches are hollow and mounted on the outer slide, cut out the blanks first, while the cupping punches working in the inner slide, work through the cutting punches, and draw the cut blanks through the dies.

No. of Press.	273	799	710	897	720	578	38	1102
No. of punches	3	1	4	4	1	3	3	4
Strokes per minute	100	100	150	70	120	100	100	70
Width of strip, inches	4½	5	6	6	3½	2½	2½	6
Size of cup made—Diameter, inches	¾	¾	.67	.69	.65	.25	.25	.25
Depth, inches	5/16	5/16	½	½	.50	.13	.13	.13
Weight, cwt.	35	30	48	63	21	8	4½	26

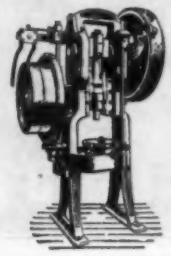


ROLLER FEED PRESSES—*continued.*

These feeds are attachable to our standard OPEN FRONT PRESSES of the following sizes. Operate tools for cutting blanks, cutting and piercing as washers, safety razors cutting, and stamping seals, chargers, &c.

No. of Press.	B1	773	764	B2	763	674	614	644	715	924	1156	704	834
Travel of rolls up to, inches	1½	5	5	5	5½	24	12	2½	5	8	3	7	5
Width of strip admissible, inches	1½	6½	6½	6½	6	T	T	3½	7	9	8	36	10
Stroke of slide, inches	1	1	1	1½	1½	3	2	2	2	2	2	3½	3½
Strokes per minute up to	100	100	100	100	100	50	50	60	50	70	70	35	25
R = Relieving rolls	R	R	R	R	R			R	R	R			
S = Scrap winder		S	S			G			G		S	G	G
Weight, cwt.	6	15	14½	21	29	37	31	48½	48	69	47	155	160

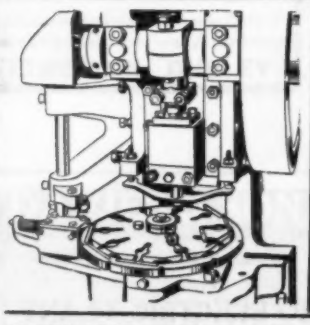
T = for Turbine Blades. G = Geared.



TURNTABLE FEED PRESSES.

These feeds are attachable to our Standard Presses, and safeguard the attendant, as articles to be operated on are placed by hand in holes provided in turntable, which rotates and brings the work into correct position every time the punch descends. Rapid production is only restricted by ability of attendant to place articles into receptacles.

No. of Press.	82	1002	1001	1056	1024	1025	1027	985	85	692	723	101	1033	1079	822
No. of dies or holes on turntable	14	16	28	28	16	16	10	12	10	10	10	10	15	18	10
Strokes per minute	30	90	98	98	60	40	50	70	50	70	70	70	70	70	10
Stroke of slide, inches	8	8	5	5	10	10	3	5	1	4	1	½	4	1	2½
Die circle diameter, inches	7½	8½	7 5/16	7 5/16	9½	9½	12	12½	13	12½	7½	7½	13	9	24
G = Geared	G				G	G	G								G
Weight, cwt.	10	27	16	16	41	38	86	19	35	14	9	5	26	9	80



TURNTABLE FEED PRESSES—*continued.*

These turntables are attachable to our Standard Presses, and are efficient for continuous output.
G = Geared. D = Plain disc feed for one die.

No. of Press.	904	795	G 877	1116	970	269	908	772	613	G 668	G 714	G 987	1143	G 702	G 561	1068
No. of dies or holes on turntable	18	16	36	32	10	D	12	13	40	6	D	8	10	10	6	10
Strokes per minute	100	50	40	56	50	70	70	150	70	30	64	50	30	20	30	40
Stroke of slide, inches	1½	1½	1½	2	3	6	7	1½	3	4	4	4	4	8	8	3
Die circle diameter, inches	10½	6½	12	11½	7½	—	20	8½	15	8	—	12	14	21	7	9
Weight, cwt.	6	7½	13	18	18	25	20	21	26	31	53	52	61	46	35	36½

PRESSES IN HEAVY TYPE ARE IN STOCK.

PRESSES, DIES, LATHES, SHEARS, for SHEET METAL WORK and SEAMLESS DRAWN METAL HOLLOW-WARE.

ARMATURE PLATE BLANKING and NOTCHING PRESSES.

NUT, BOLT, and WASHER PRESSES.

MINTING, COINING, CARTRIDGE, GUNPOWDER, and SPECIAL MACHINERY.

AS USED BY LEADING MANUFACTURERS.

SHOWROOMS adjoin the Offices of Messrs. TAYLOR & CHALLEN, Ltd., where Customers may inspect finished PRESSES, PRESSES in motion, and samples of presswork produced thereon. An Overhead Electric Crane is installed, which ensures prompt despatch of PRESSES ordered.

MAKERS of PRESSES for SHEET METAL WORK, SEAMLESS HOLLOWWARE, ELECTRICAL STAMPINGS, and ALL DIE PRESSED WORK. Also PLANTS for COINING, MINTING, CARTRIDGE and GUNPOWDER MANUFACTURE.

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LONDON OFFICE: ST. STEPHEN'S HOUSE, VICTORIA EMBANKMENT, S.W. 1.

Telegrams: "DERWENT, B'HAM." — PRICES AND FURTHER PARTICULARS ON APPLICATION — Telephone: { B'HAM. CENTRAL 376. LONDON, VICTORIA 3513

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MAKE ALL KINDS OF BELT AND DIRECT-COUPLED MOTOR DRIVEN
PRESSES
WHICH WILL ECONOMICALLY PRODUCE MANUFACTURERS ENGINEERING DETAILS IN AN EFFICIENT WAY FROM STRIP AND PLATE METAL
BY THE USE OF T&C PRESSES CASTINGS ARE SUPERSEDED BY SEAMLESS METAL WORK

"MARSHALL"
STEAM ROAD ROLLERS

Have justly acquired their High Reputation

BY VIRTUE OF

PERFECT DESIGN, WORKMANSHIP & FINISH,

CONSISTENT FUEL ECONOMY, ABSOLUTE DEPENDABILITY AND LOW MAINTENANCE COSTS.

Hundreds of "Marshall" Road Rollers are in service all over the world, giving Complete Satisfaction to Owners and Users.

PRICES FOR 1922 GREATLY REDUCED

Made—as Single Cylinder and Compound Types—in Weights 5 to 20 tons:

Equipped with Scarifiers, Awnings, Governors, Water Sprayers, Special Fireboxes and Convertible Traction Appliances :: to meet all requirements at Home or Abroad.

IMPORTANT:

Every Roller has the "MARSHALL" PATENT FIREBOX; a design of Guaranteed Strength and Unique Simplicity. No bridges, stay-bolts and longitudinal stays. No collecting zone for deposit. Absolute interior freedom for cleaning. Maximum Evaporative Efficiency. . . . Write for full particulars.

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Ask for our Catalogue & Prices. Mention "The Engineer." Send us your inquiries. Delivery from Stock.

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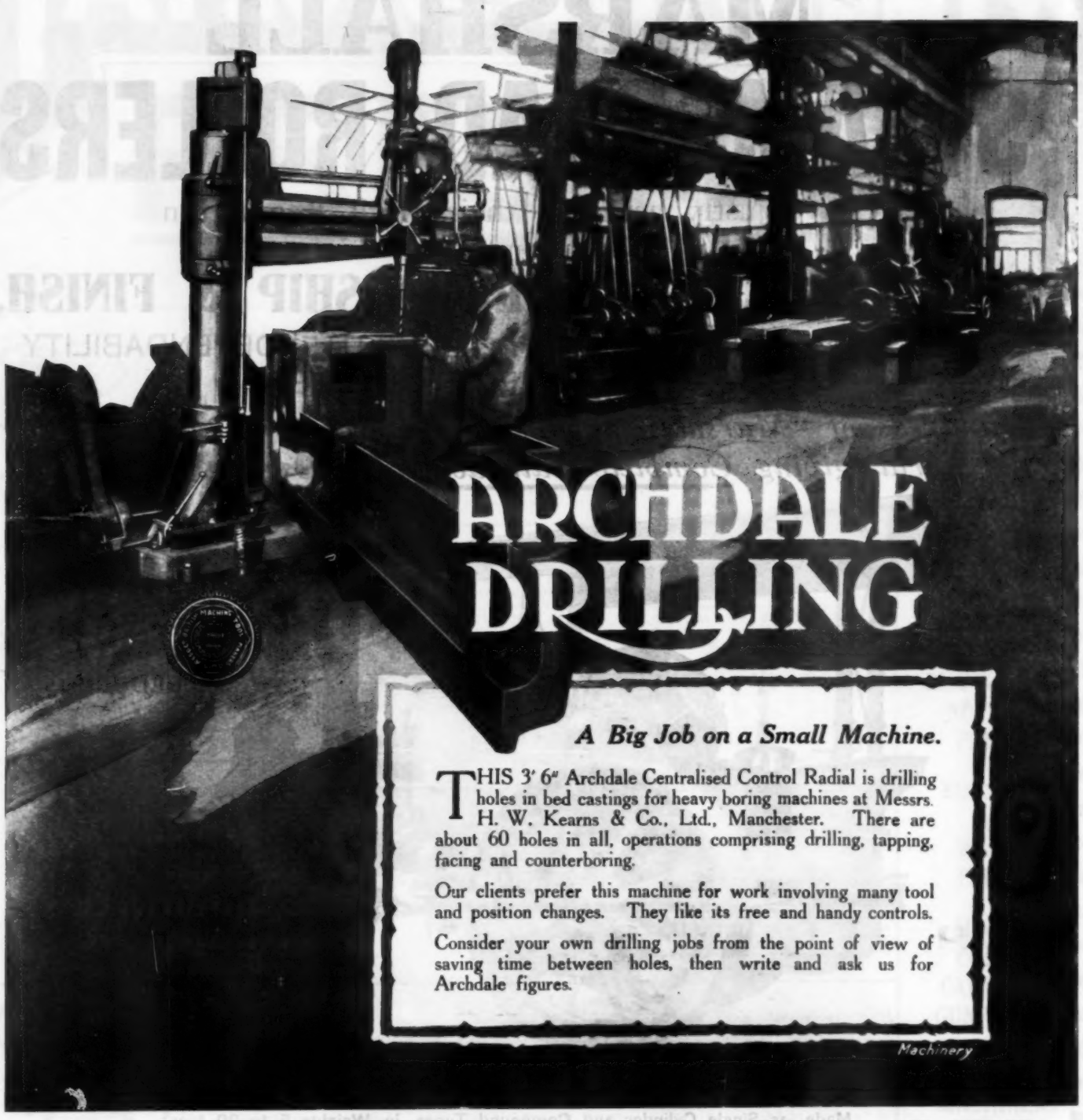
9 A

ASSOCIATED BRITISH MACHINE

17, GROSVENOR GARDENS

MANCHESTER - LEEDS - GLASGOW - BIRMINGHAM



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A Big Job on a Small Machine.

THIS 3' 6" Archdale Centralised Control Radial is drilling holes in bed castings for heavy boring machines at Messrs. H. W. Kearns & Co., Ltd., Manchester. There are about 60 holes in all, operations comprising drilling, tapping, facing and counterboring.

Our clients prefer this machine for work involving many tool and position changes. They like its free and handy controls.

Consider your own drilling jobs from the point of view of saving time between holes, then write and ask us for Archdale figures.

Machinery

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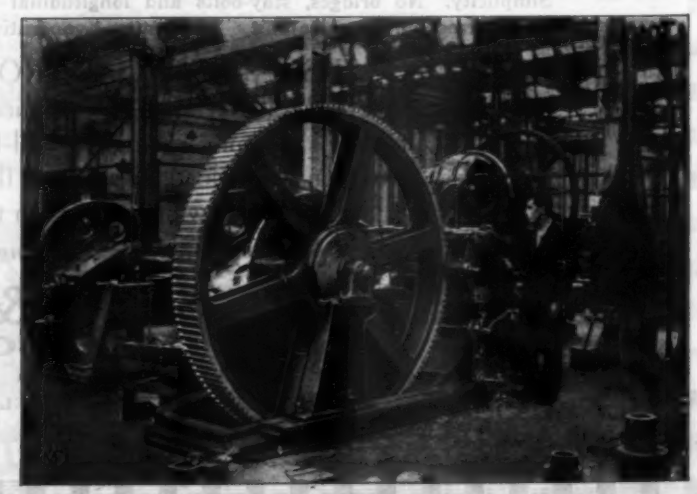
"SUNDERLAND" GEAR PLANERS.

No. 11 Machine—
Capacity: 6ft. dia. × 10½in. face, 1¼ D.P.

No. 11 E Machine—
Capacity: 8ft. 6in. dia. × 10½in. face, 1¼ D.P.

Send for new list BB.4 of latest models.

J. Parkinson & Son, SHIPLEY.



No. 11 E Machine cutting large gear in the works of the Reid Gear Co.

TOOL MAKERS LIMITED

LONDON, S.W.1.

THOMAS SHANKS & CO.,

JOHNSTONE, near GLASGOW.

HIGH SPEED VERTICAL & HORIZONTAL

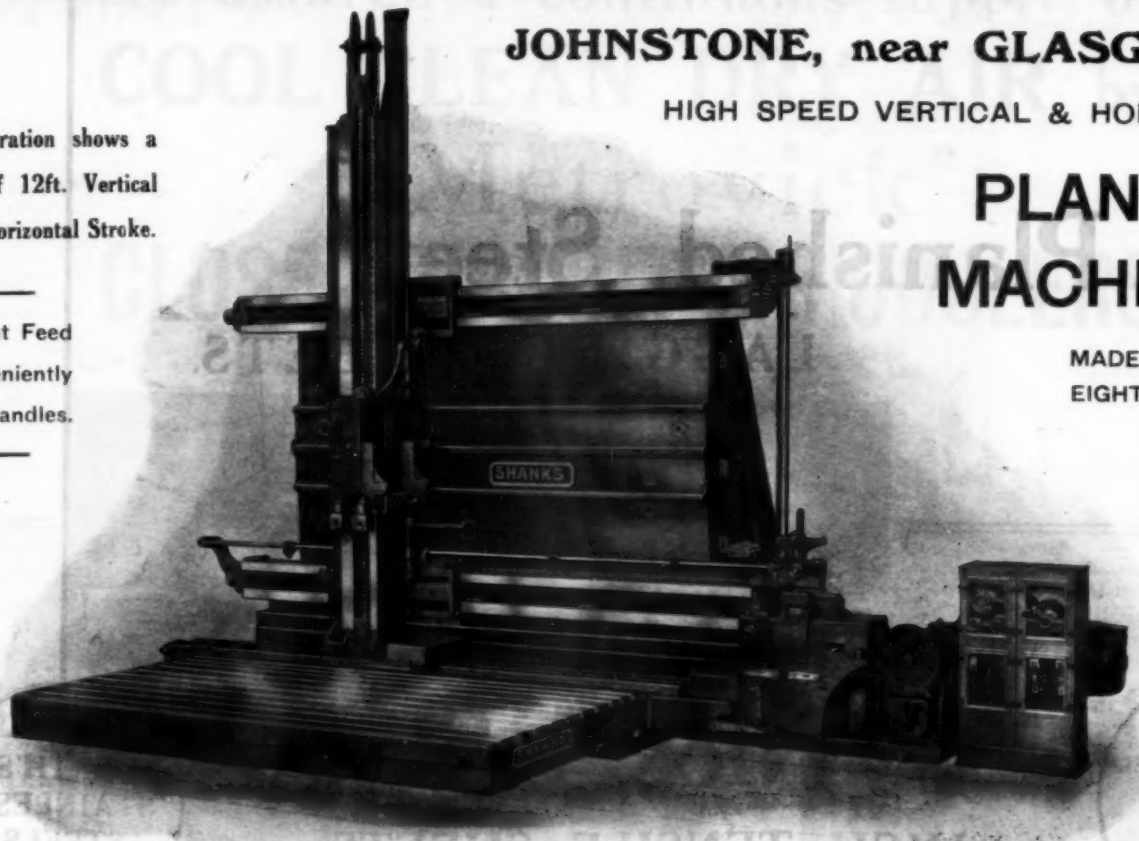
PLANING MACHINES.

MADE IN . .
EIGHT SIZES.

NEWCASTLE - PARIS - BRUSSELS - CALCUTTA

The Illustration shows a Machine of 12ft. Vertical by 14ft. Horizontal Stroke.

See Patent Feed with conveniently grouped handles.



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THE SMALL STEP OF THE CONE.

Ideal progression of speeds and increase of power are the claims for our latest model of Fasthead with two reductions by Gearing.

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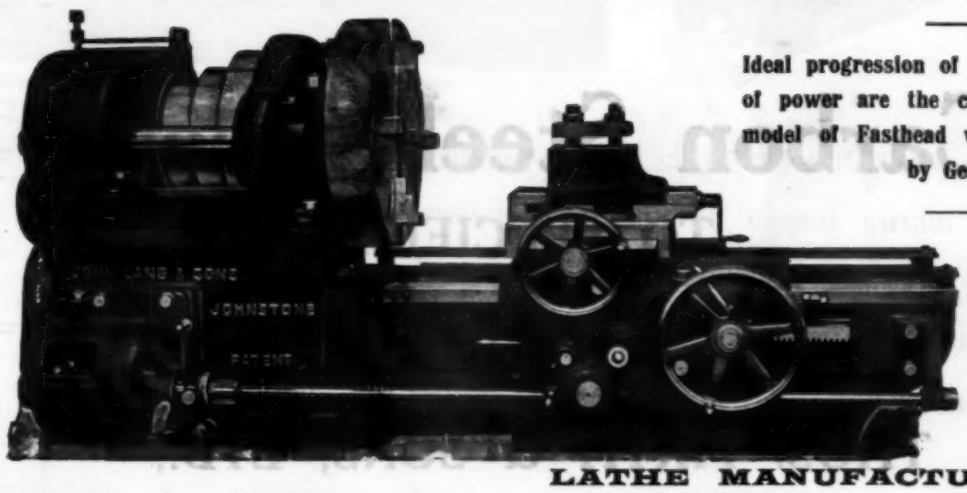

3-STEP CONE GIVING 9 SPEEDS— GEARING IN FRONT.

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JOHN LANG & SONS, LTD., JOHNSTONE, NEAR GLASGOW.

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We equip machine shops with machine tools, transmission, motors, stores, etc.—our service is complete. We have done it for others to their profit and satisfaction—why not for you?

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"SPEEDICUT" HIGH-SPEED STEEL.

"SPEEDICUT" HIGH-SPEED DRILLS, CENTRE DRILLS, MILLING CUTTERS REAMERS, &c.

"INSTO" INSERTED TOOTH SAWS.

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Planished Steel
LAGGING SHEETS.

BEST CAST STEEL FILES.

5% Nickel Steel
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FIRTH'S STAINLESS STEELS.

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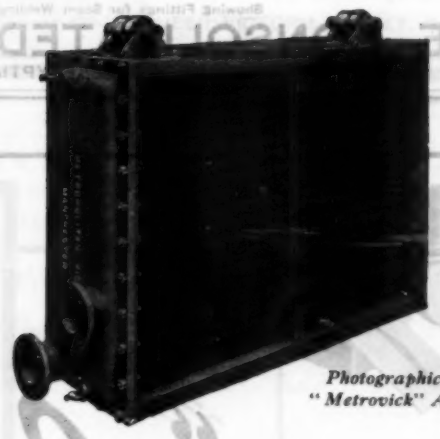
are assured a continuous supply of COOL CLEAN DRY AIR by "Metrovick" CLOSED CIRCUIT AIR COOLERS

Diagram indicating the application of "Metrovick" Closed Circuit Air Coolers.



Photographic view of "Metrovick" Air Cooler.

A plentiful and continuous supply of cool clean dry air is assured by means of the "Metrovick" system of closed circuit air coolers. All dirt and free moisture is excluded and risk of fire is reduced to a minimum. Basement space is economised and no extra pumps or motors are required. It reduces noise and is safe, simple, reliable and inexpensive.

FIFTY SETS IN OPERATION & ON ORDER

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Trafford Park - - Manchester.

THE Mark of Efficiency.

C30

C

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PNEUMATIC AND ELECTRIC DRILLS

CONSOLIDATED PNEUMATIC

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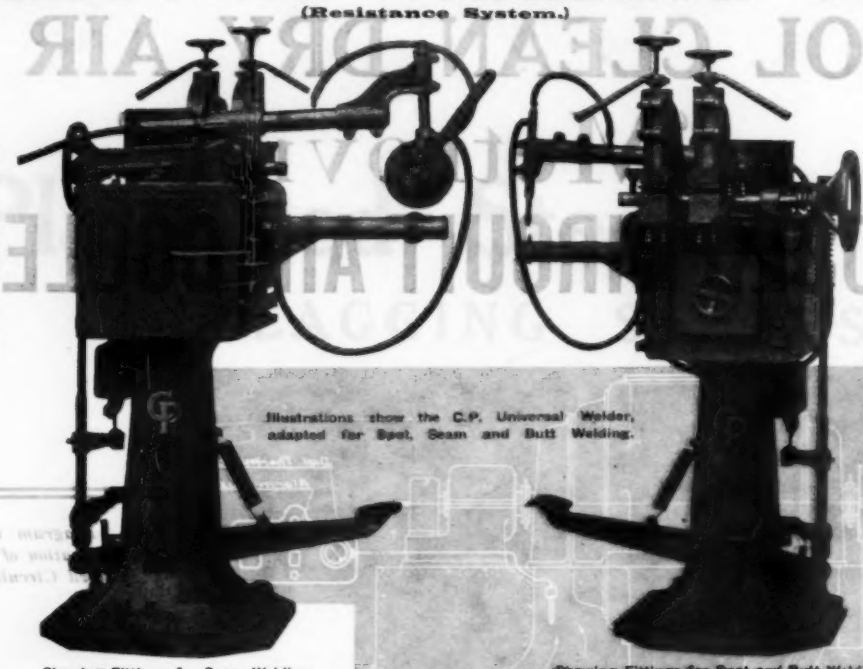
Tel. No.: GERRARD 9215.

C.P. ELECTRIC WELDING PLANTS.

(Resistance System.)

Resistance Welding is most economical. There is no possibility of danger to the worker, the temperature is more easily and accurately adjusted, no flux is necessary, it is clean and easily operated by semi-skilled or unskilled labour, and is specially adapted to work of reasonably small dimensions which can be taken to the welding appliance, though with some of our special designs of Spot Welder, large pipes, ventilating cowls and steamers' funnels, may be spot welded.



Illustrations show the C.P. Universal Welder, adapted for Spot, Seam and Butt Welding.

In order to meet the growing demand for a reliable and efficient electric welding system, we have developed an apparatus which combines many unique features; one type of machine in particular, our Universal Welder, enables the user to obtain the advantages of spot, seam and butt welding in one machine. Firms who have no great amount of any particular kind of welding, but have a miscellaneous range of welding work, will find this new type of great use. Single-Purpose welders can also be supplied.

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Showing Fittings for Seam Welding.

Showing Fittings for Spot and Butt Welding.

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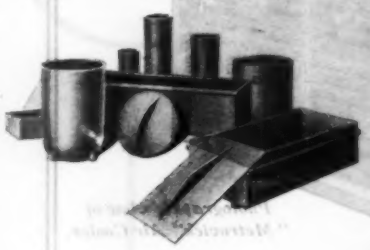

A Railway Company used an iron vessel. Its life worked out to £1 per heat.

A Cronite vessel did the same work at a cost of 8s. 1d. per heat.

If you use Cronite vessels you can save as much or more. Try a few and see for yourself.

"Cronite"

NICKEL-CHROMIUM ALLOYS FOR ALL TEMPERATURES WHERE OTHER METALS COLLAPSE.

MELTING POINT 1420° C.

GLASS PLANT. HEAT TREATMENT VESSELS.

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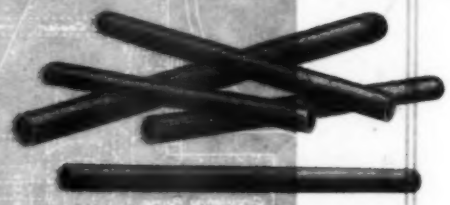


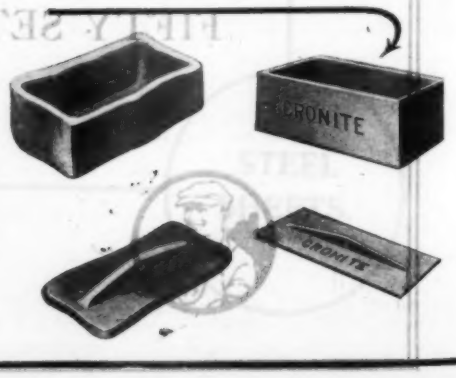
WHAT IS CRONITE?

A Nickel-Chromium alloy which retains 12-15 tons of its tensile strength at 1000° C.

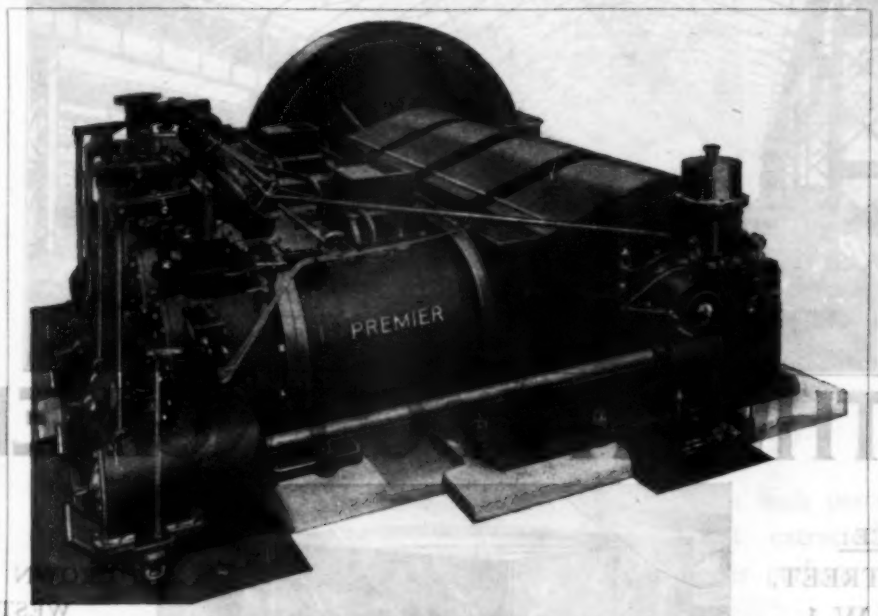
WHAT ARE ITS ADVANTAGES?

Cronite Castings are reduced by 20 to 50% in weight compared with Ferrous Vessels. Distortion and scaling are practically eliminated. You Save Fuel. You Save Labour. You Save Money. You Secure Efficiency. You Make More Profit.

We only claim what has been proved.



PREMIER
LARGE GAS ENGINES



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MULTICYLINDER
120 B.H.P. TO 1000 B.H.P.

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MULTICYLINDER
1000 B.H.P. UPWARDS.

EXTREMELY EVEN TURNING MOMENT AND STEADY RUNNING.
SPECIALLY ADAPTED FOR DIRECT COUPLING TO ELECTRIC GENERATORS.
LOW FUEL CONSUMPTION - COMPLETE ACCESSIBILITY - CONTINUOUS RELIABILITY.

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SILENT

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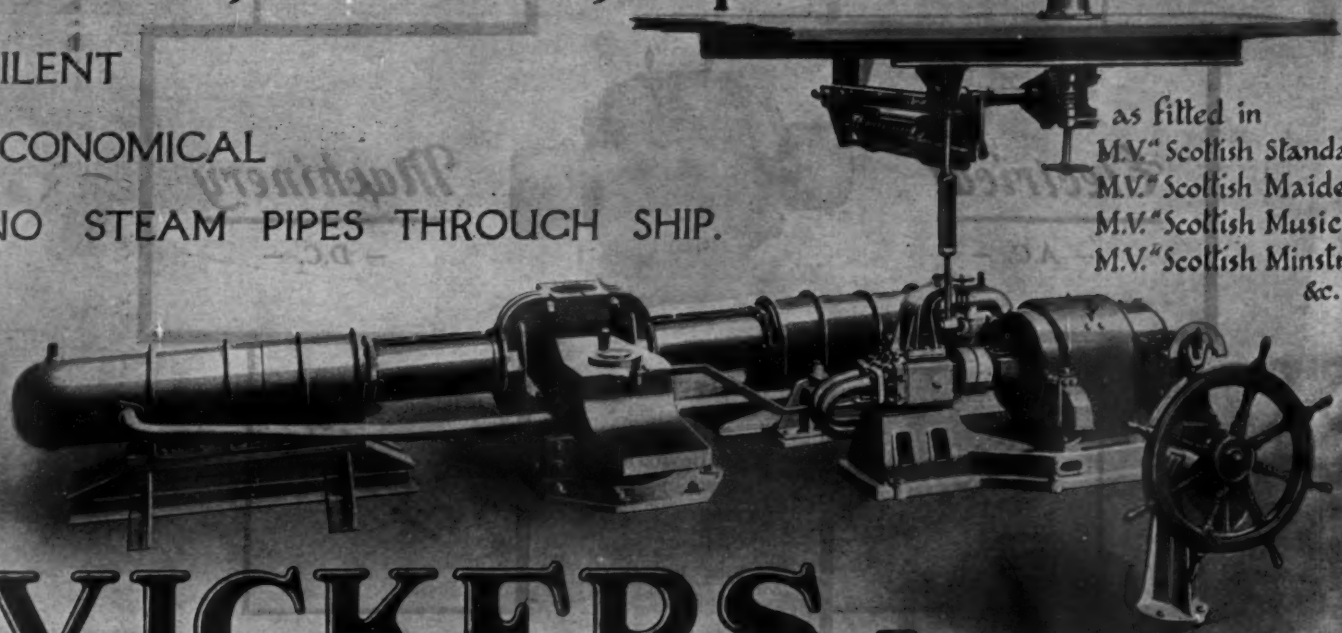
NO STEAM PIPES THROUCH SHIP.



as fitted in
M.V." Scottish Standard"
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&c.&c.

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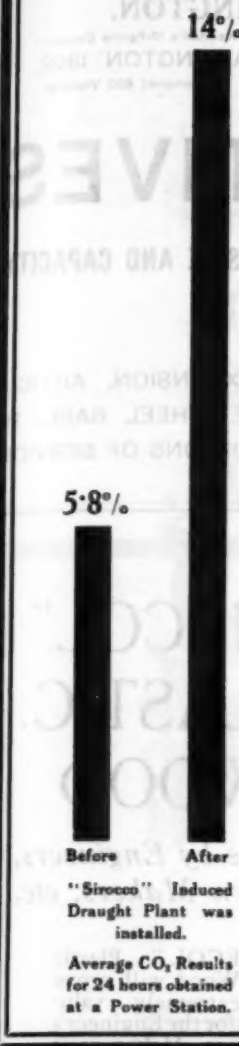

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Average CO_2 Results for 24 hours obtained at a Power Station.

Increase the CO_2

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Mechanical Draught

Induced Draught. Forced Draught.
Balanced Draught.

A high percentage of CO_2 means good combustion and fuel economy.

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Efficiency Proved: The Authority using this Machine have now ordered

THREE ADDITIONAL 'RUSTON' EXCAVATORS.

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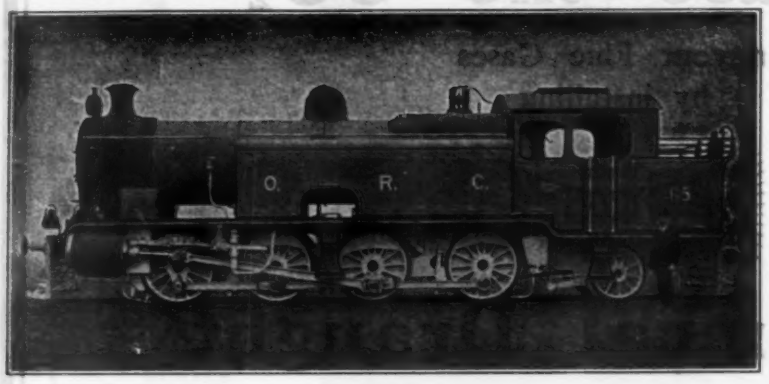

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OF THE HIGHEST CLASS UP TO ANY SIZE AND CAPACITY.

SPECIAL LOCOMOTIVES—SINGLE EXPANSION, ARTICULATED or other types with FLEXIBLE WHEEL BASE, TO SUIT ANY GAUGE OF RAIL AND CONDITIONS OF SERVICE.

Bright Steel Bars
Cotters & Pins
for the Loco shop.

It means a lot to have Bright Steel Bars, Cotters and Taper Pins just right. It saves both time and trouble in the assembling. Getting them right, therefore, saves money. That explains the big orders we receive from loco. shops. Mills' Cotters and Pins, etc., are all made right—and they are all ready for delivery, all sizes. Write for our lists.

Exors. of
James Mills Ltd.
Bredbury Steel Wks,
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PUSHING PRODUCTION to meet the demand necessitates the saving of all useless operations about the plant, among which is the constant repacking of piston rods and small valves, which may be avoided by using

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the packing that has the quality that gives long satisfactory service. Such a packing may cost a little more than ordinary packing, but is worth it because of the big saving in the labour of frequent application.

Let us send you working samples to test. No charge.

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"NECOL" Plastic Wood will prove extremely valuable for the Engineer's Pattern Maker as it is capable of being moulded to any form, and when set hard can be worked up with the usual tools in every way similar to wood. Fillets, either straight or in the most intricate curves, can be modelled quite easily either with the fingers or a hollow tool, and will set hard overnight.

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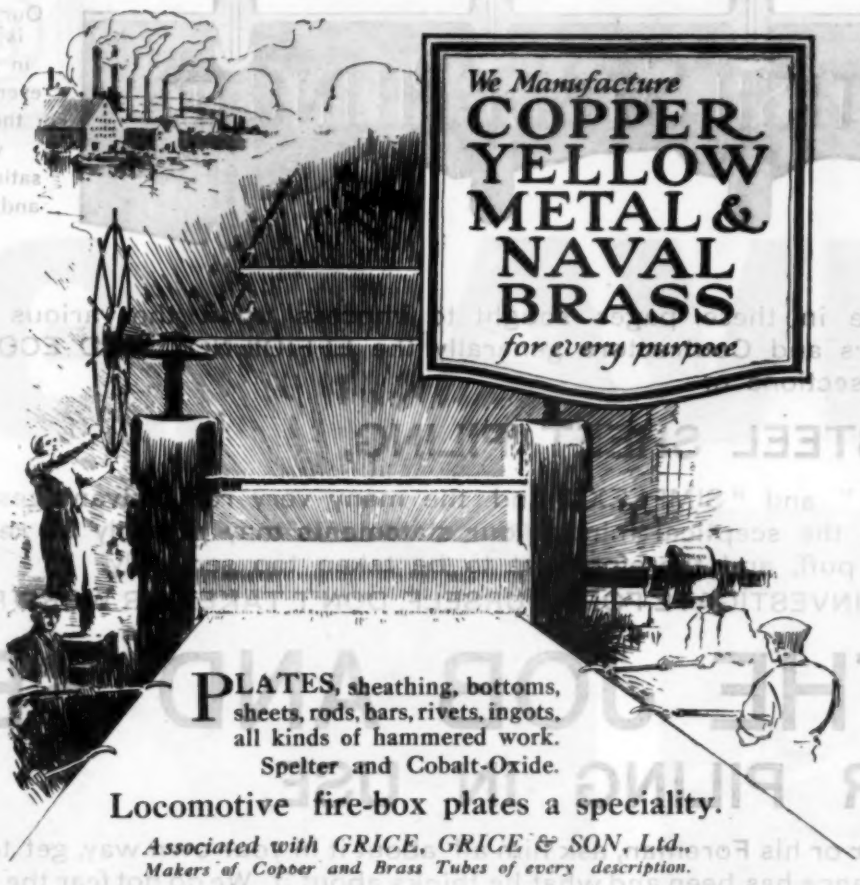

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The paint is sprayed evenly and continuously through a flexible tube and nozzle, supplied with compressed air, either from existing air mains or from our special Compressors.

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Pay first cost in a short time as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again & again

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SECTIONS OF "UNIVERSAL JOIST" STEEL SHEET PILING.

There is no Pile Driving Work in which our Piling cannot be profitably employed.

Our Piling is used in nearly every part of the World with satisfaction and profit.

WE have from time to time in these pages sought to impress upon the various Public Authorities and Engineers and Contractors generally the EFFICIENCY AND ECONOMY of our two well-known sections of

STEEL SHEET PILING,

the "UNIVERSAL-JOIST" and "SIMPLEX," and the many very real advantages to be gained by their use. To the sceptical minded our statements may possibly be regarded as so much advertising puff, and therefore not to be taken too seriously.

To all such we simply say INVESTIGATE FOR YOURSELF, DON'T TAKE OUR WORD FOR IT,

GO TO THE JOB AND SEE
OUR PILING IN USE.

Get hold of the Contractor or his Foreman, ask him all about it in your own way, get to know from him what his experience has been and what he thinks about it. We do not fear the results.

HERE ARE A FEW OF THE UNDERTAKINGS IN PROGRESS **TO-DAY** IN ENGLAND (Foreign Contractors please write for nearest job in your own country) WHERE YOU CAN SEE OUR PILING IN USE :—

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S. Pearson & Sons	L.C.C. Storm Relief Sewer, Charlton
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Our Piling can be withdrawn as easily as it is driven.

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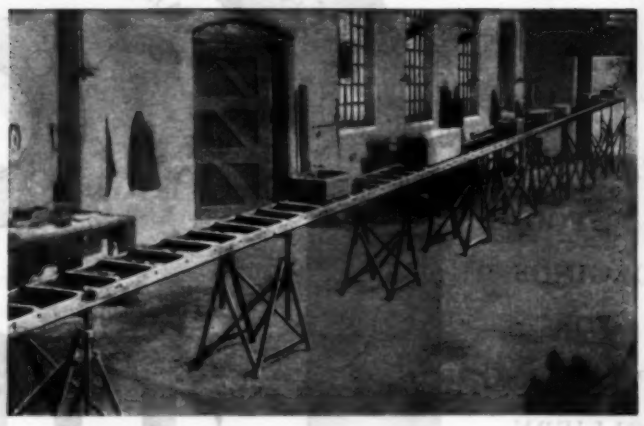
CONVEYORS

GRAVITY



GRAVITY CONVEYORS.

The illustrations on this page show very clearly some of the uses of Gravity Roller Conveyors. This type of Conveyor costs NOTHING to operate. Being light and easily dismantled it can be moved from place to place if required in a few minutes. It will in many cases pay for itself hundreds of times over. When sending enquiries please state the maximum and minimum sizes of the boxes or cases which you use.

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BRITISH MANNESMANN WELDLESS STEEL

IN LENGTHS UP TO 75 FEET WITHOUT CROSS WELD

MAIN STEAM PIPE INSTALLATIONS A SPECIALITY

IN ALL DIAMETERS UP TO 14 INCHES

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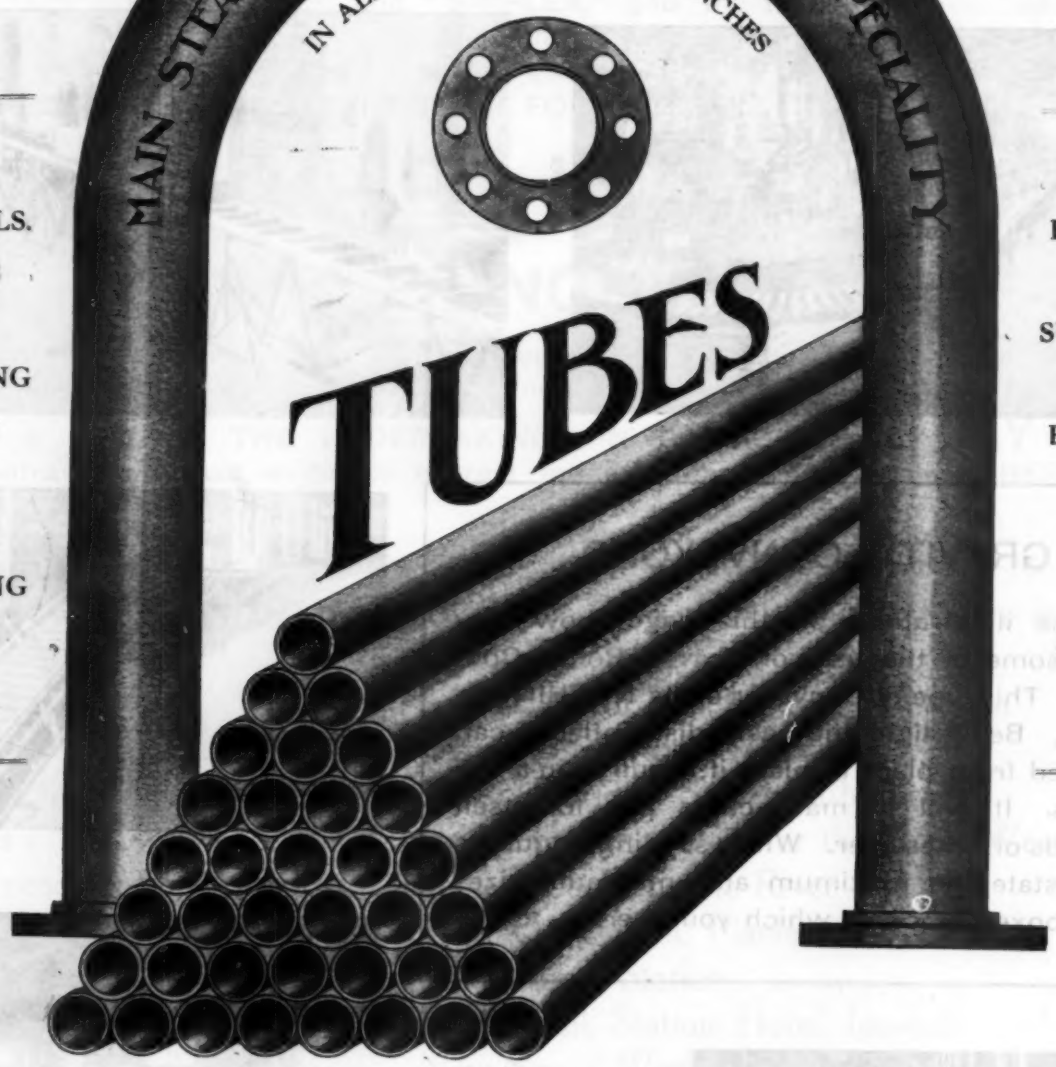

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ALSO MANUFACTURERS OF

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FROM 14in. UP TO 72in. DIAMETER FOR ALL PURPOSES.
LENGTHS UP TO 25 FEET.

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Works: LANDORE, S. WALES, & NEWPORT, MON.

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DESIGN No. 27

Ross Automatic Drop-Bar Screens

BUILT by experts as the outcome of long, practical experience in screening, the Ross Automatic Drop-Bar Screen has proved the solution of many problems connected with grizzly feeding and screening.

The Ross Screen is the only screen operating on the principle of *instantaneous* and complete separation. Degree of screening is from 93 to 100%. Simplicity of release at the discharge point ensures absolute freedom from congestion. Operation is noiseless and dustless, and there is a power saving of 80% as compared with other methods.

No special foundations are required for the installation of the Ross Screen. Working parts are simple and extremely durable, thus, first costs are economical, and upkeep costs practically negligible.

The Ross Screen will handle any material, continuously with efficiency. A 3ft screen will handle material at 60 cu ft. per minute.

Fully descriptive Catalogue on request.

Complete Mining Equipments.

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Crushing and Ore Dressing Plants
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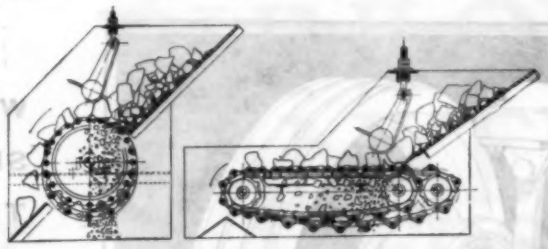

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GRIP POSITIVE AND EQUAL AT ALL POINTS OF TREAD.

EXTREMELY SIMPLE AND ABSOLUTELY EFFECTIVE.

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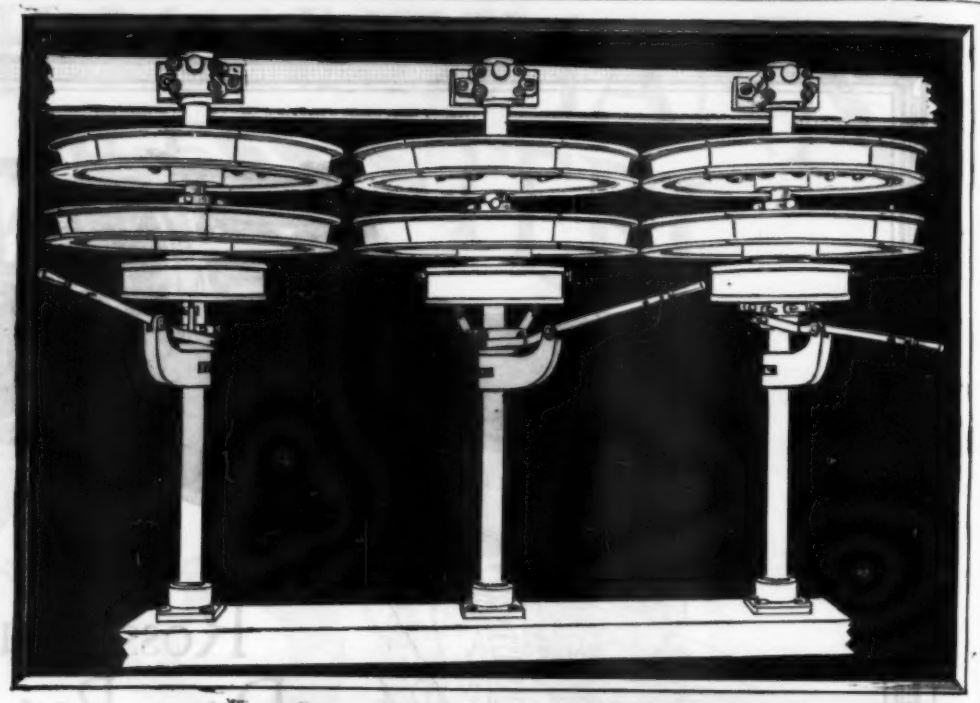

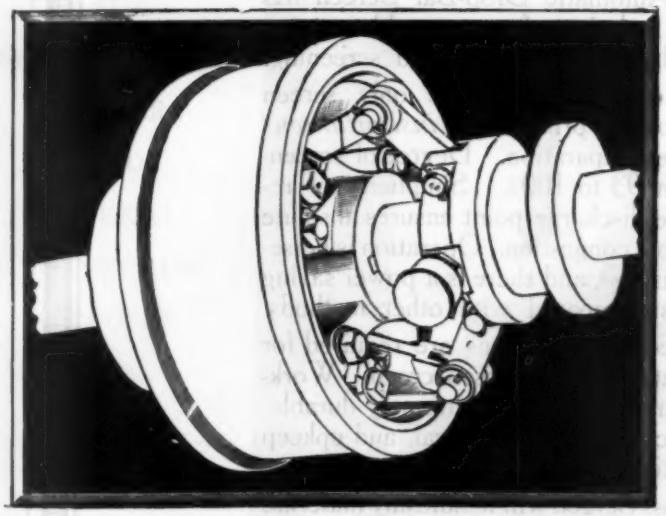

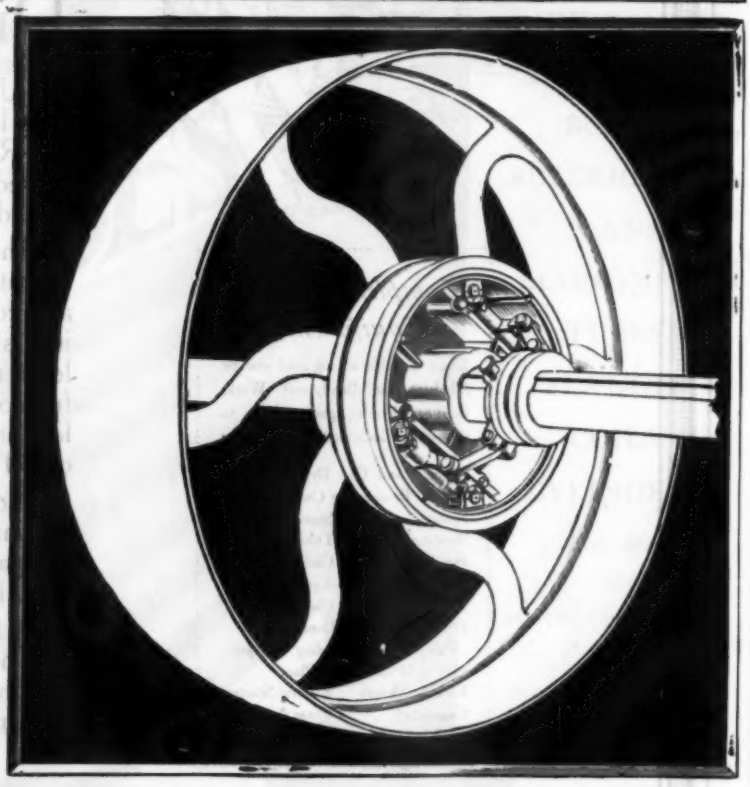

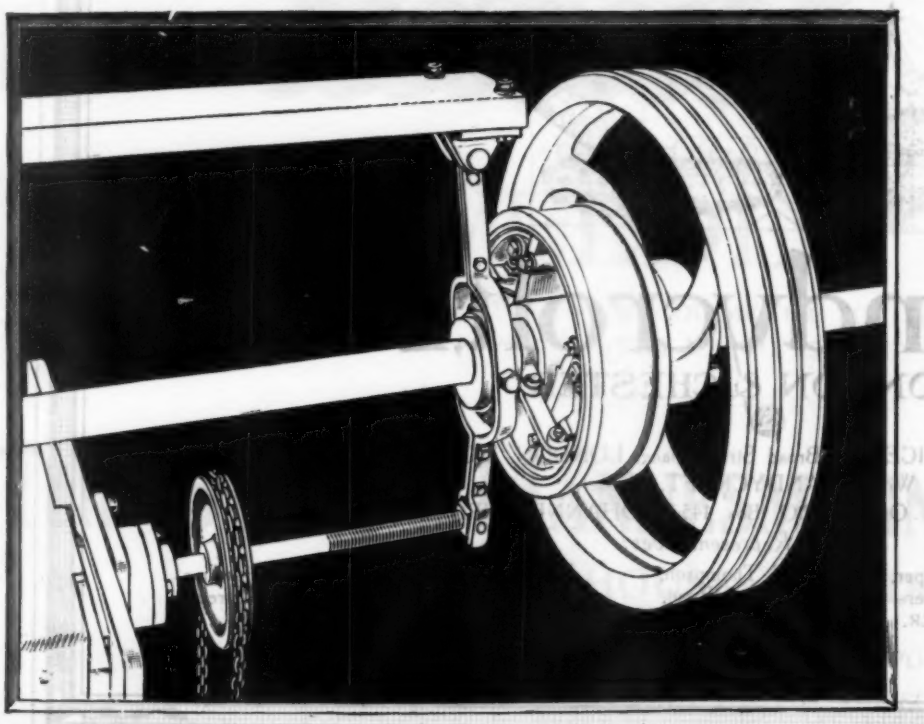

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for
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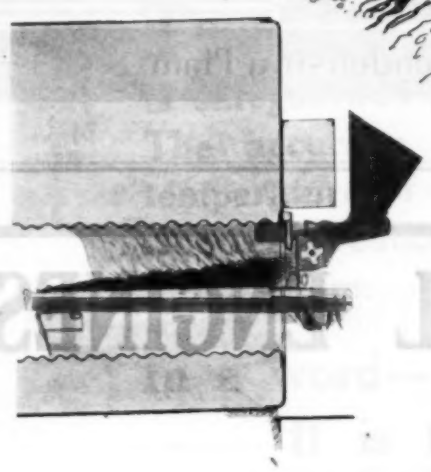
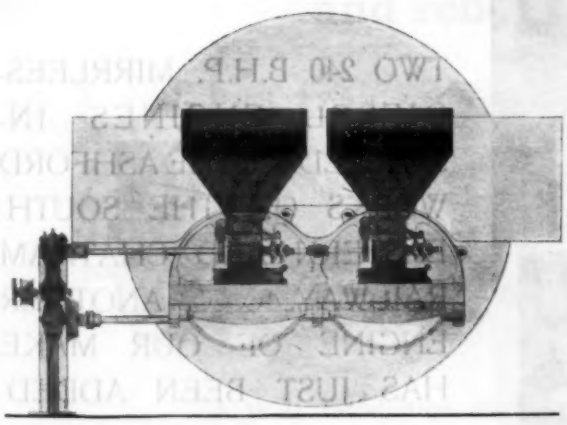
From the Poets——————No. VI

"Many things, impossible to thought,
Have been by need to full
perfection brought!"
Dryden



LABOUR difficulties, and the increasing complexity of modern industrial processes, have perhaps been the two chief factors in the invention and development of machinery. Steam raising to-day calls for expert knowledge of the principles of combustion and "Bennis" Stokers embody every feature which goes to the raising of steam scientifically—that is to say—cheaply, rapidly, efficiently. It is the same with the "Bennis" methods of handling coal and ashes. To appreciate the perfection to which these machines have been brought, a perusal of our finely printed and fully illustrated catalogues is essential. They can be had free for the asking. Write to-day.



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MULTIJECTOR AIR PUMPS.

THE SIMPLE TYPE.
With a 5000 K.W. Turbine would use 770 lbs. of operating steam per hour.

¶ Highest vacuum efficiency coupled with Lowest nett B.T.U. consumption per lb. of air extracted of any air pump made.

¶ No auxiliary water other than condensate is required and practically the whole of the heat of the steam is recoverable for useful work.

¶ At present serving steam condensing plants with a total steam duty of over 7,000,000 lb. of steam per hour.

¶ May also be applied for Industrial purposes with improved working efficiency where vessels under vacuum are used for Drying, Separation, Evaporation, Crystallation, Distillation and Recovery.

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THE CENTRAL CONDENSER TYPE.
With a 5000 K.W. Turbine would use 330 lbs. of operating steam per hour.

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Specialists in Design & Manufacture of Condensing Plant

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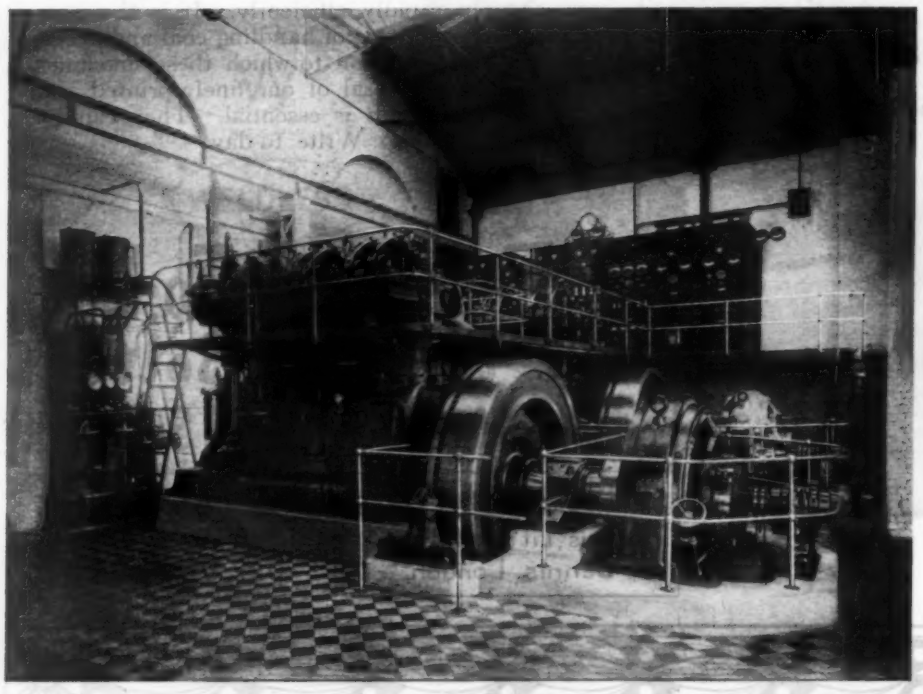
MIRRLEES - DIESEL OIL ENGINES.



TWO 240 B.H.P. MIRRLEES-DIESEL ENGINES INSTALLED AT THE ASHFORD WORKS OF THE SOUTH-EASTERN AND CHATHAM RAILWAY. - - ANOTHER ENGINE OF OUR MAKE HAS JUST BEEN ADDED.

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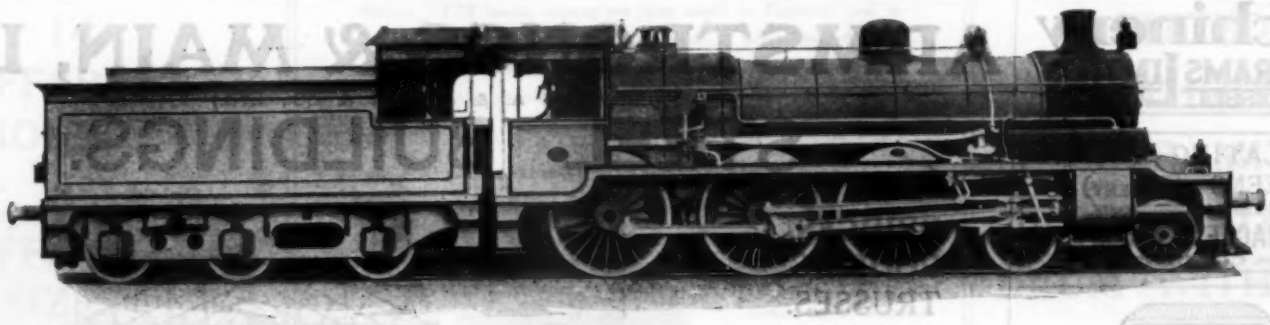
The heater contains no Joints under high pressure and is safeguarded from the action of temperature variations. The accuracy of adjustment, combined with the high temperature of feed obtained, effectively eliminate boiler troubles, reduce repairs and maintenance charges to a minimum.

In a word—

It is the simplest, most efficient and reliable system yet introduced.



A Weir Installation on Locomotive built by Messrs. The Vulcan Foundry, Ltd.

Detailed particulars on application.

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OIL SEPARATOR
FOR EXHAUST
STEAM
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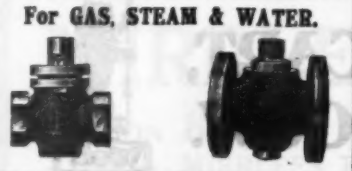
CAST IRON & G.M. COCKS
For GAS, STEAM & WATER.

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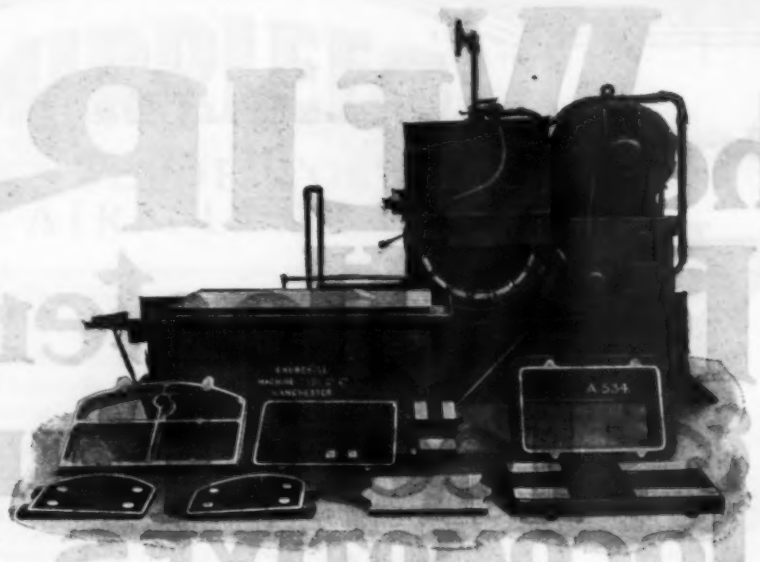
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Designed for flat surface grinding of all kinds and on all materials.

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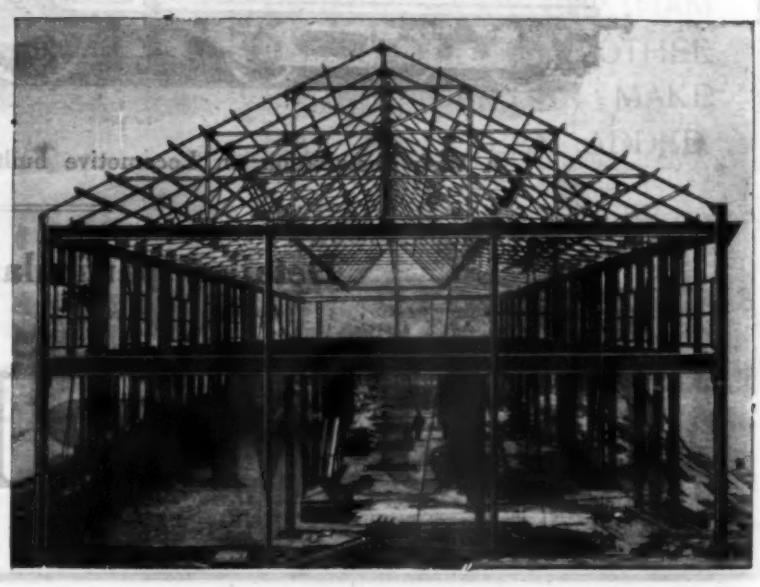

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SUITABLE FOR ANY CLASS OF FUEL.

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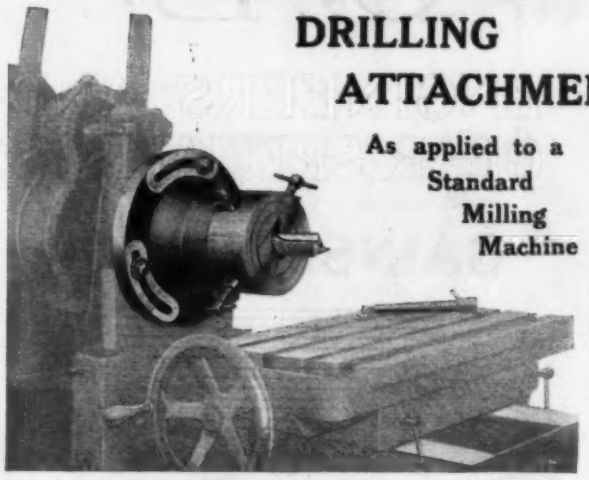
A SQUARE HOLE Drilled from the Solid in one operation

SQUARE-HOLE-DRILLING

THE RADBORE HEAD DRILLING ATTACHMENT

As applied to a Standard Milling Machine



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Complete Square Hole Drilling Machines also supplied.

SQUARE-HOLE-DRILLING

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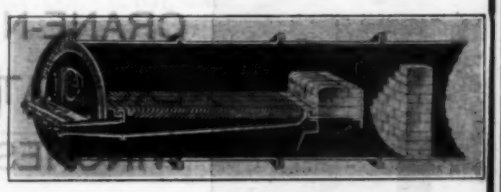

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"The undersigned (Superintendent of the Widnes Fire Brigade) desires to state that during the fire which occurred at the works of the British Everite and Asbestilite Works, Limited, on Monday night, the 8th instant, the Everite Asbestos-Cement Corrugated Sheets on the roof of the burning building were exposed to intense heat, and alternately subjected to streams of water, forced on to them from at least half-a-dozen hose pipes, without being affected in the slightest degree. It is evident to me that this Everite Sheeting, in holding the roof together as it did, prevented the fire from spreading to other portions of the Works' building. I noticed also that the same sheets suffered no damage from the weight of several men operating from the roof in their endeavours to locate the source of the flames."

The "Widnes Weekly News" reports:

"On Monday night an outbreak of fire occurred on the second floor of one of the main buildings of the British Everite and Asbestilite Works, Limited. The flames quickly reached up to the roof of the building. Within a few minutes after the works' buzzer had given the fire signal, the works' staff arrived, and immediately made a determined effort to check the rapid spread of the flames along the Belfast trusses of the roof. The Widnes Fire Brigade were quickly on the scene, and with the assistance of staffs from adjacent works, the fire was extinguished. An important feature about this fire is that although the Belfast trusses and the boarding are partly destroyed, charred through as they are, they remain in position, and the Everite Asbestos-Cement Corrugated Sheeting on the roof actually prevented a collapse of the roof whilst the fire was in progress. Had the sheeting given way at even one point, the influx of air would have caused the fire to spread along to other parts of the building, bringing about serious damage; and without doubt, a cessation of work altogether for some considerable time. As it was, the Everite Sheets were exposed to intense heat, and alternately subjected to streams of water forced on to them from at least half-a-dozen hose pipes, yet they were not affected in the slightest degree. It was clearly evident that the Asbestos-Cement Corrugated Sheeting (the firm's own product) prevented an extensive and disastrous fire, holding the roof together as it did. Plans for the re-erection of the building include the replacing of the charred wood trusses by steel work, on which the fire-tested sheets of Everite are to be re-layed. This procedure, after the exposure they have had alternately to heat and water, and, in addition, the strain put upon them in carrying the weight of persons operating from the roof in their endeavours to locate the source of the flames, is surely a magnificent testimonial for the product of a rapidly growing industry."

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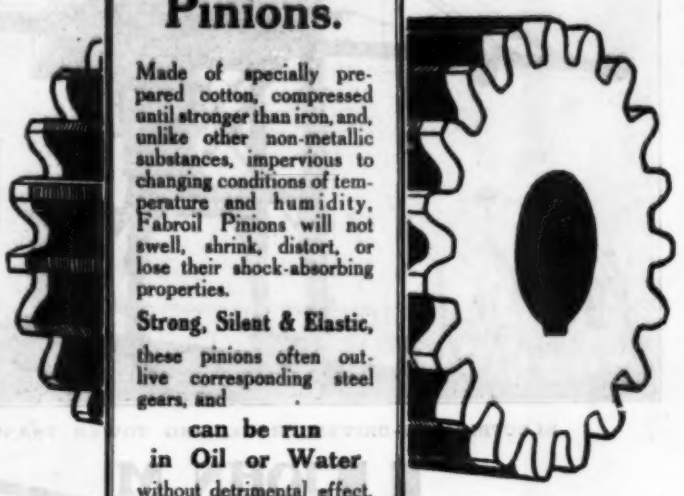

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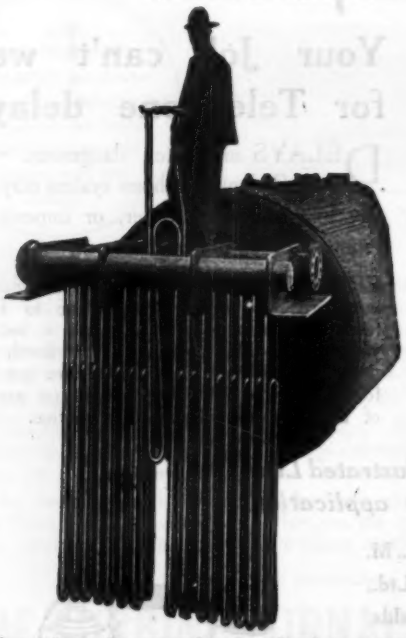

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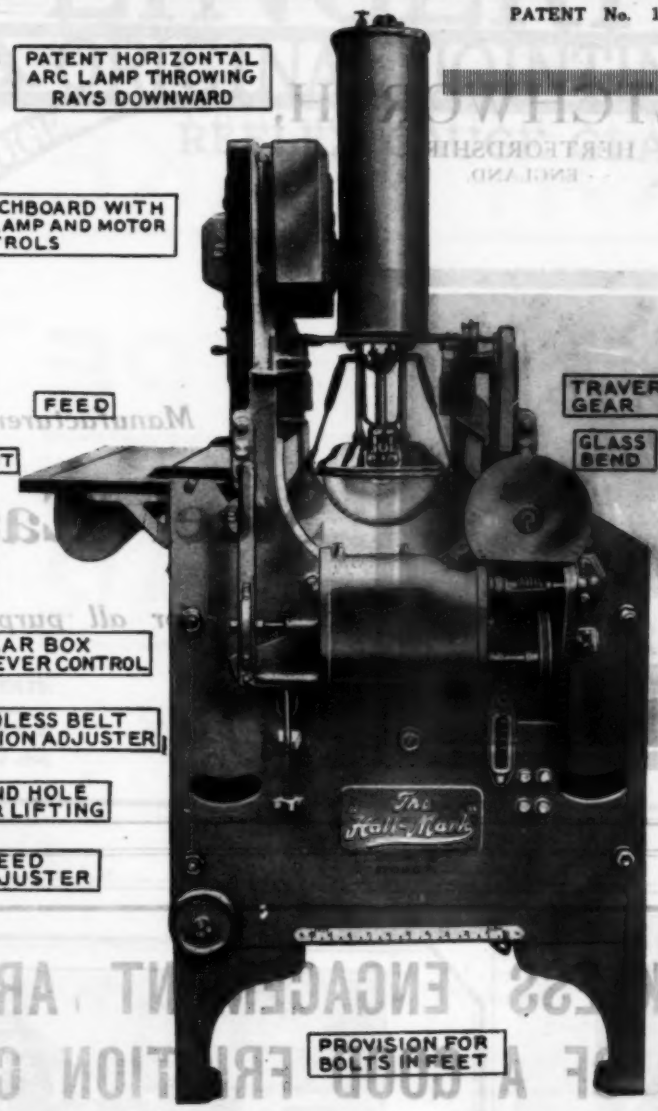

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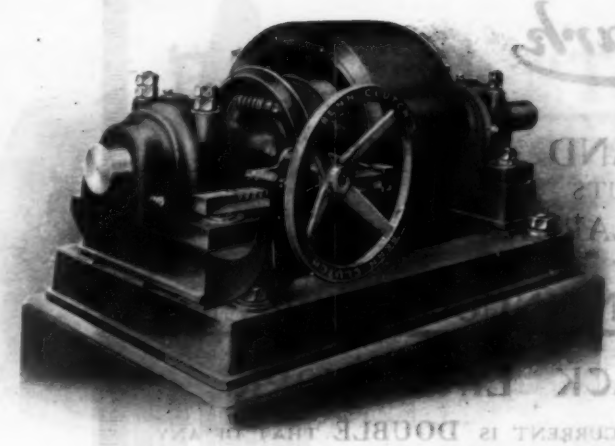

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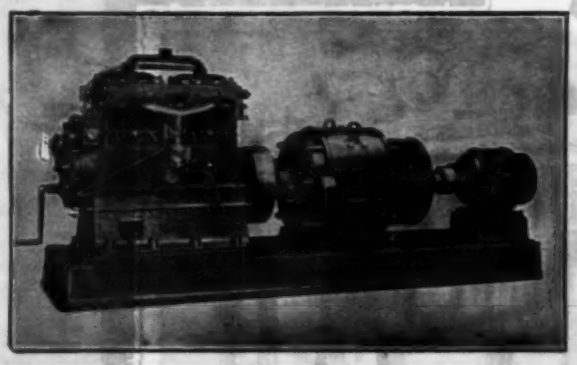

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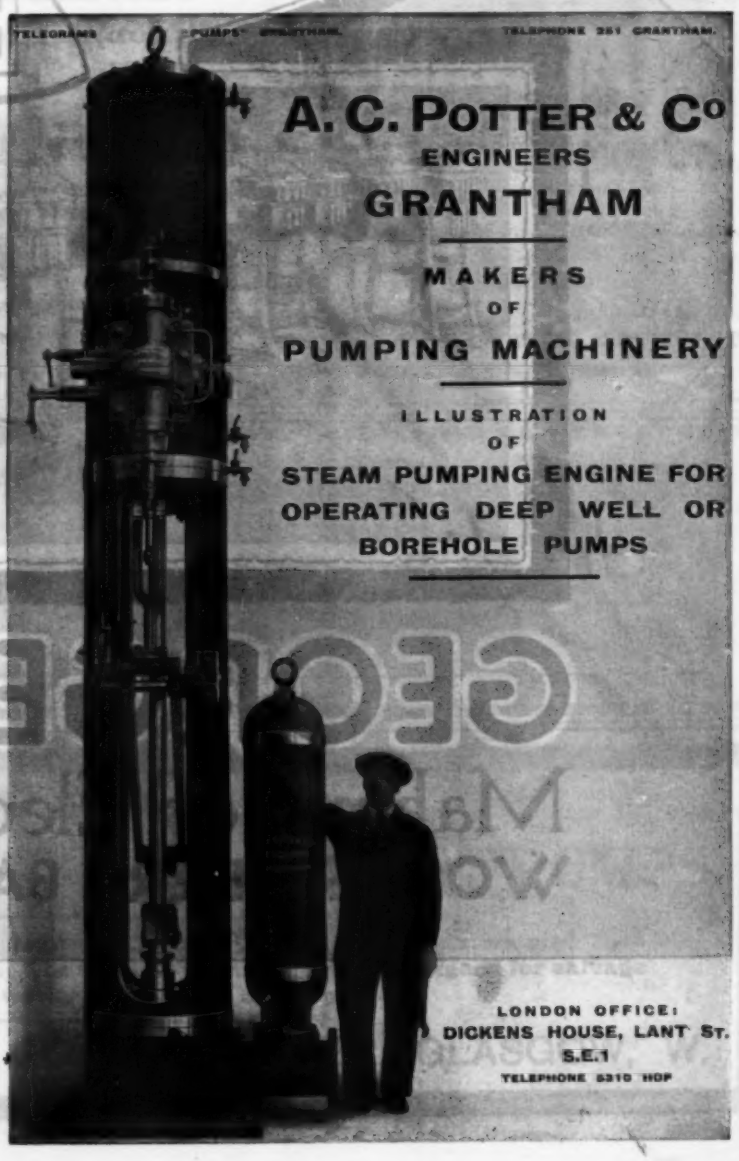

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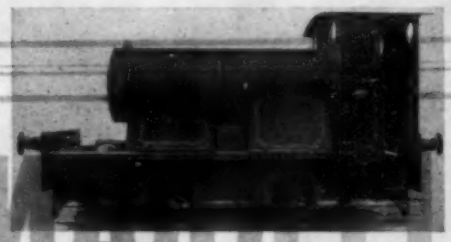

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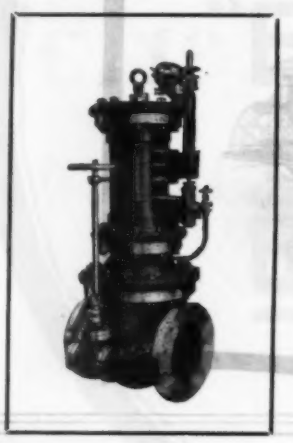

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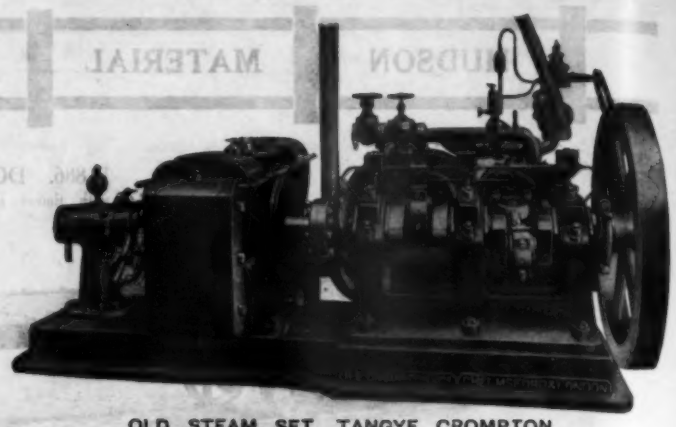

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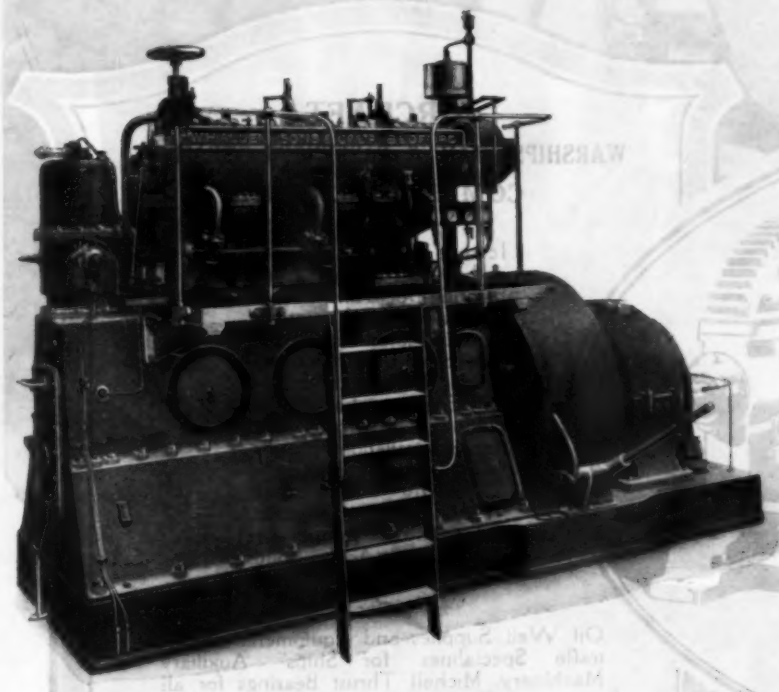

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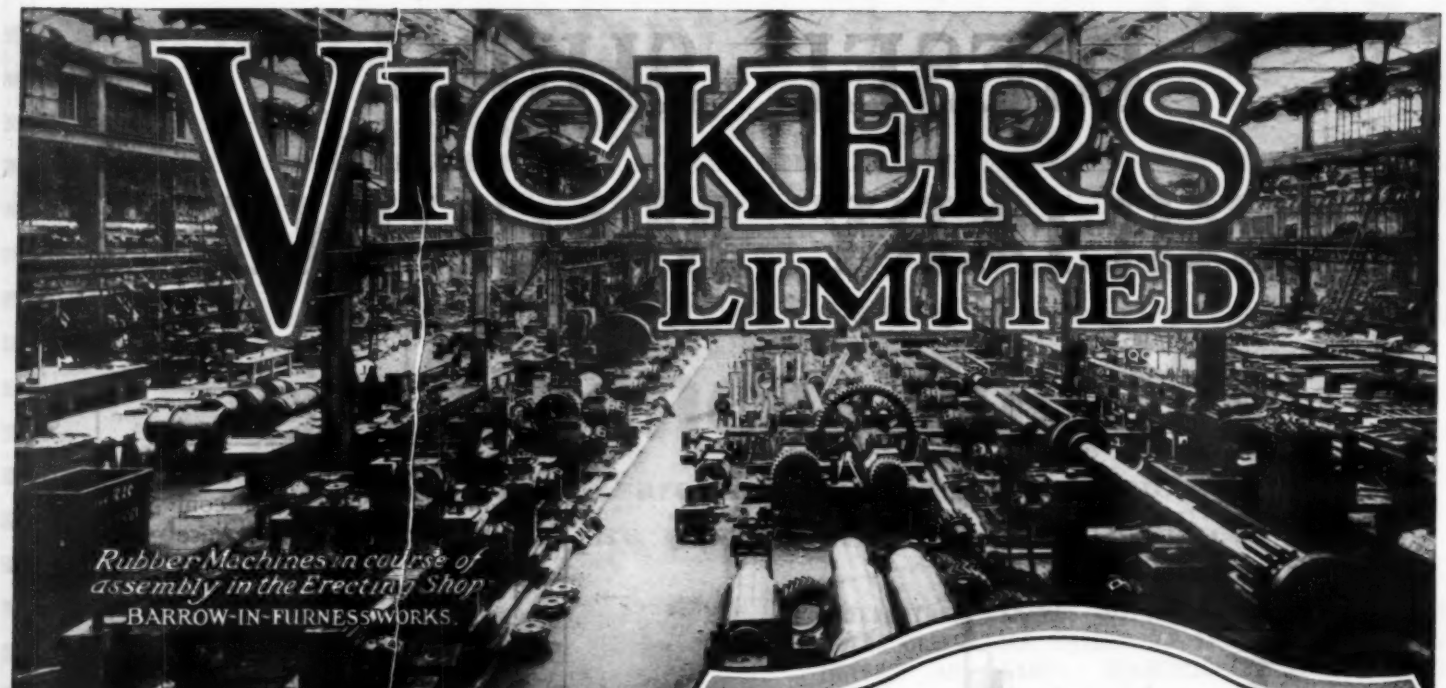

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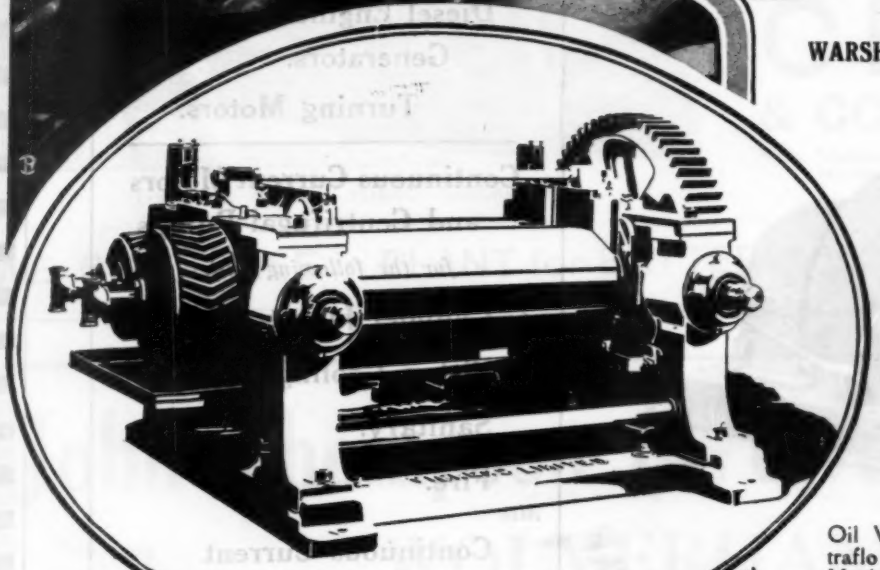

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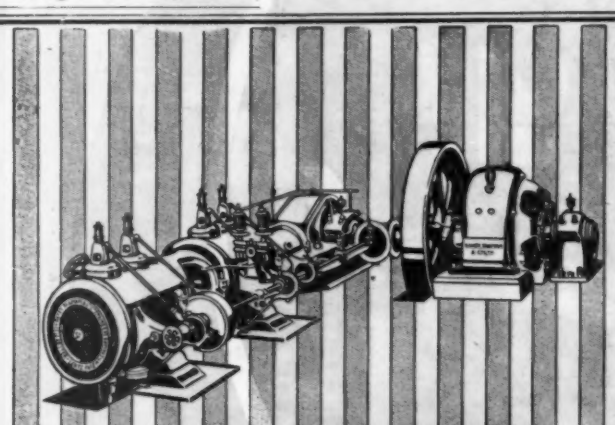

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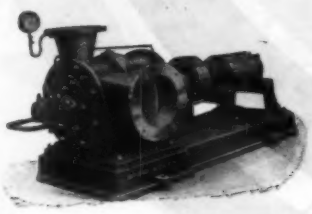

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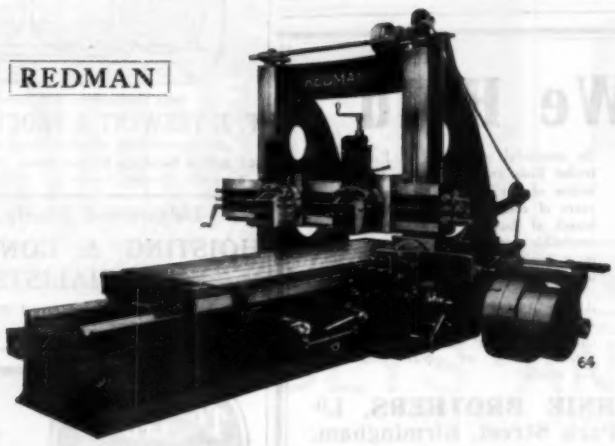

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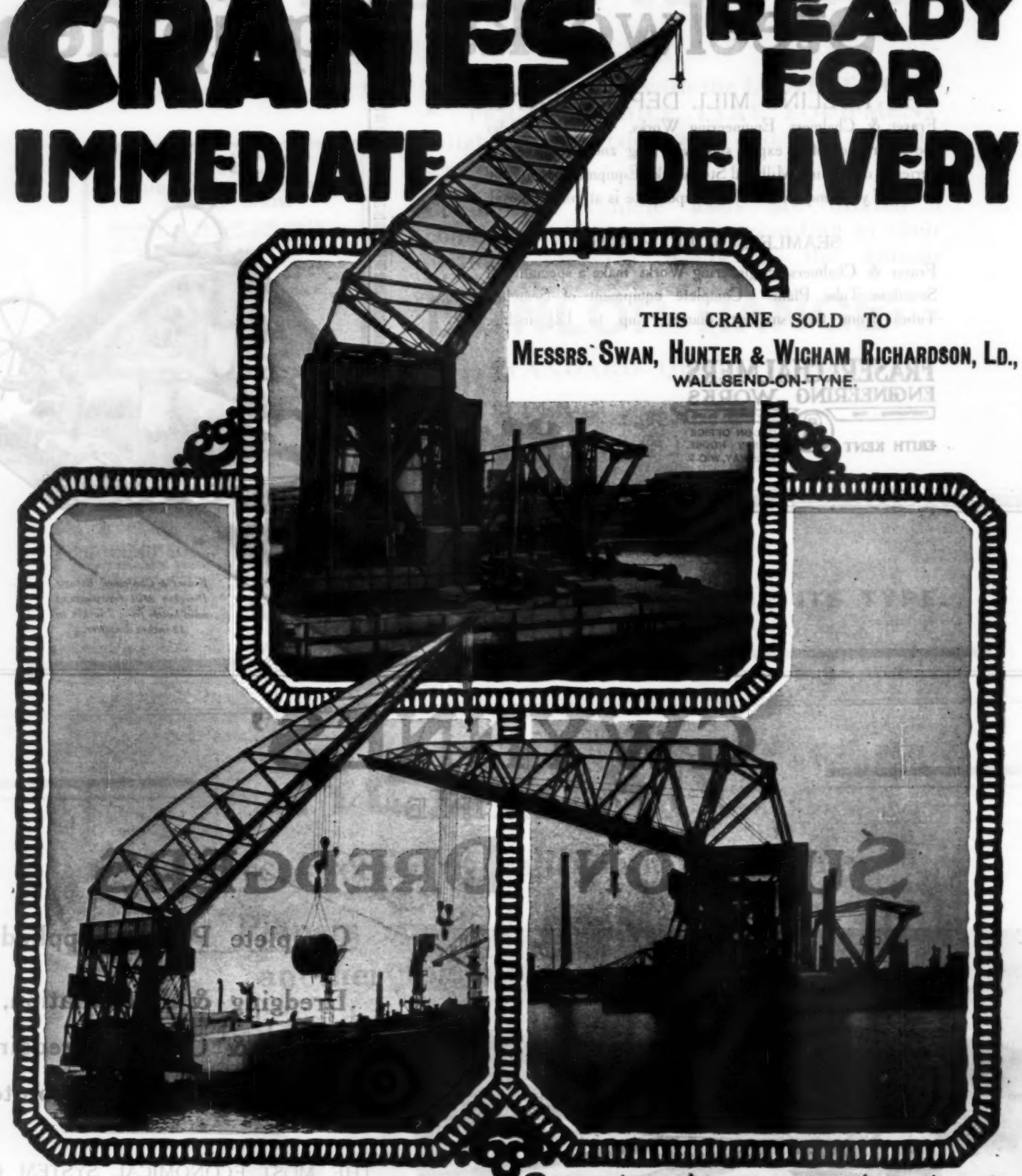

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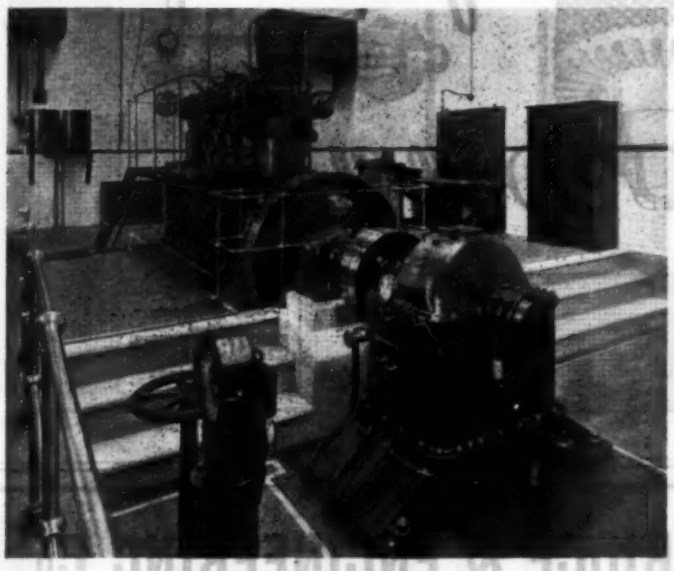

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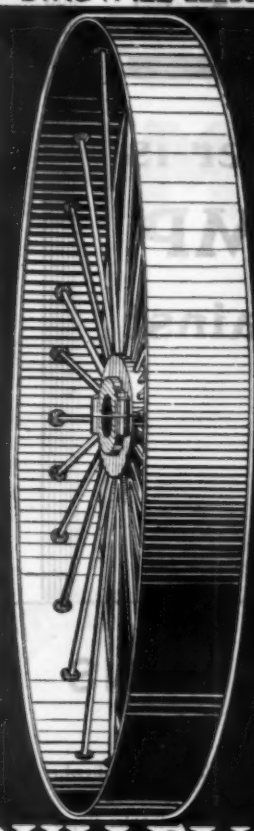

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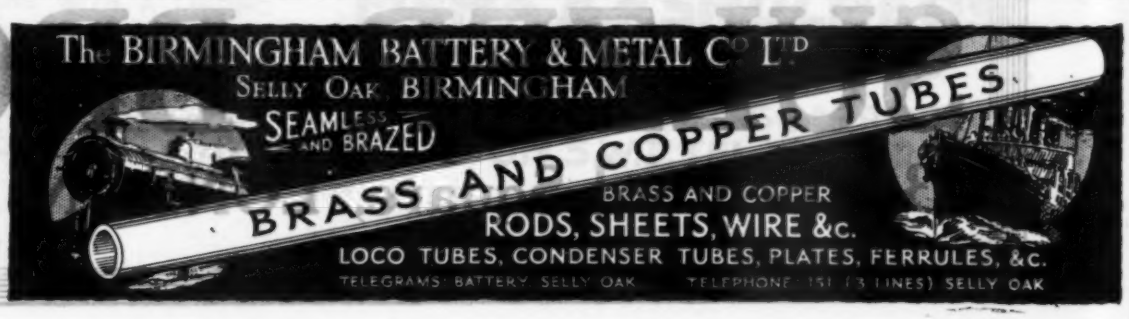

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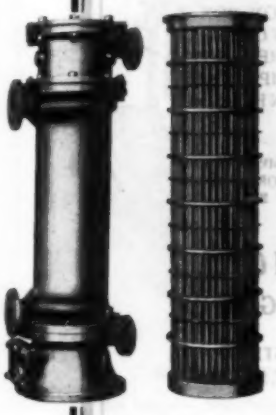

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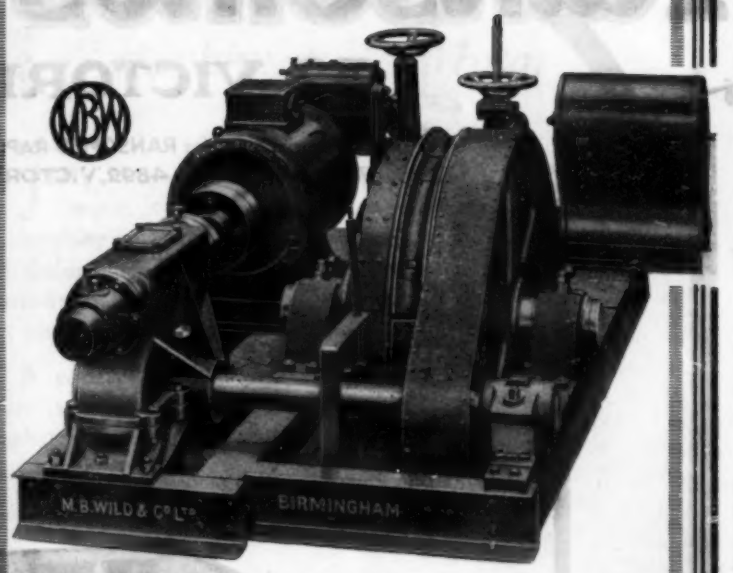

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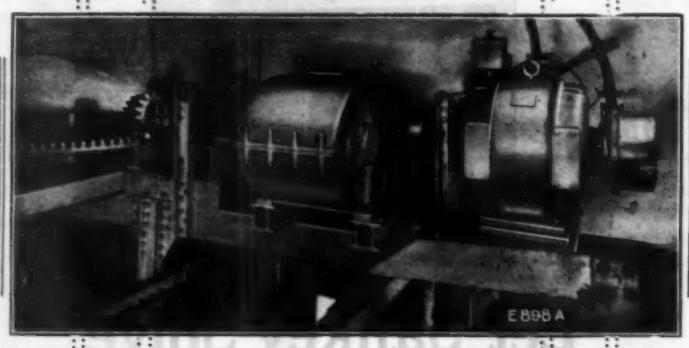

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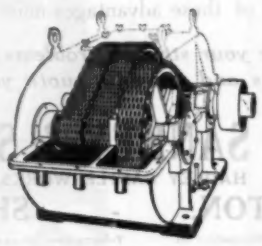

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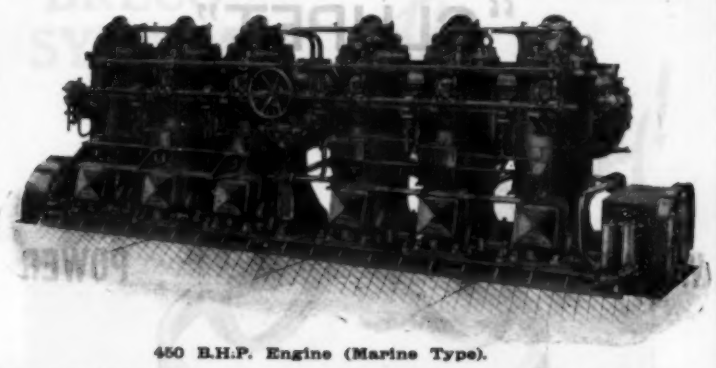

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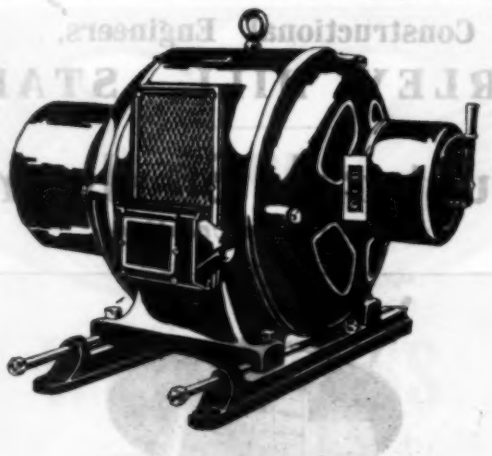

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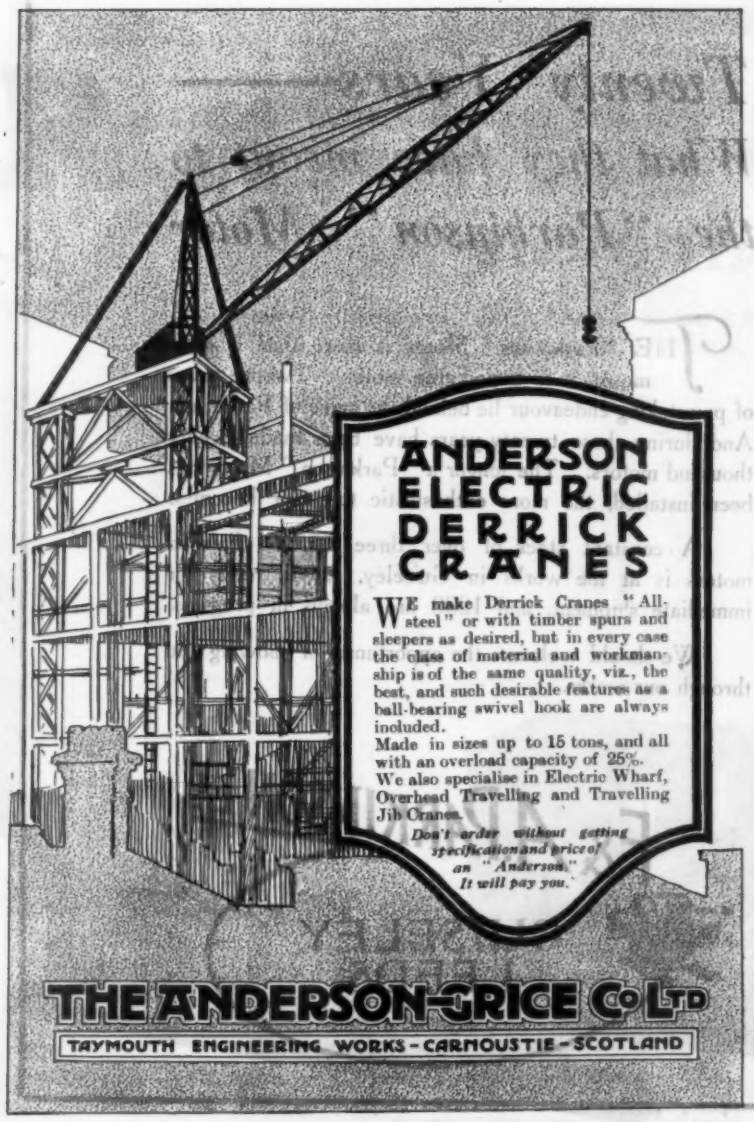

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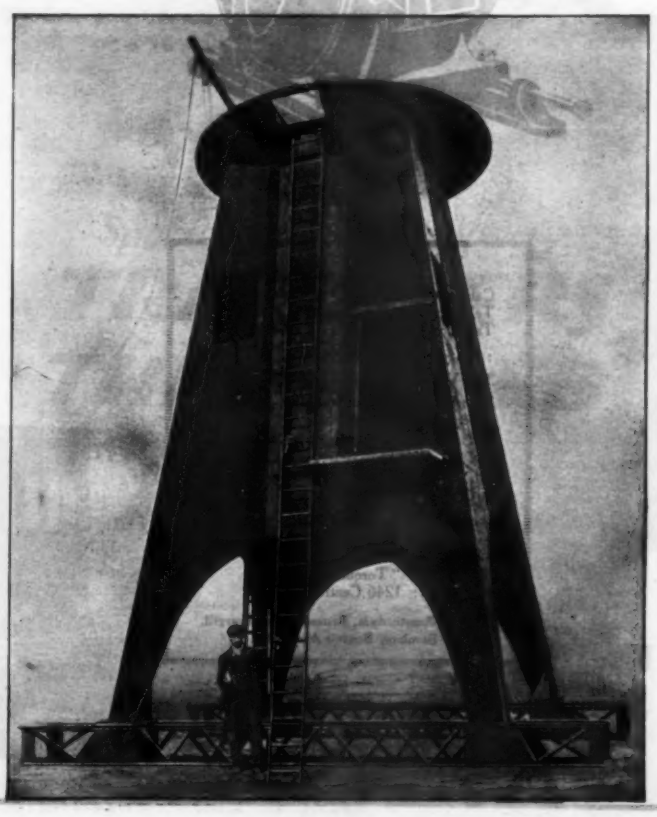

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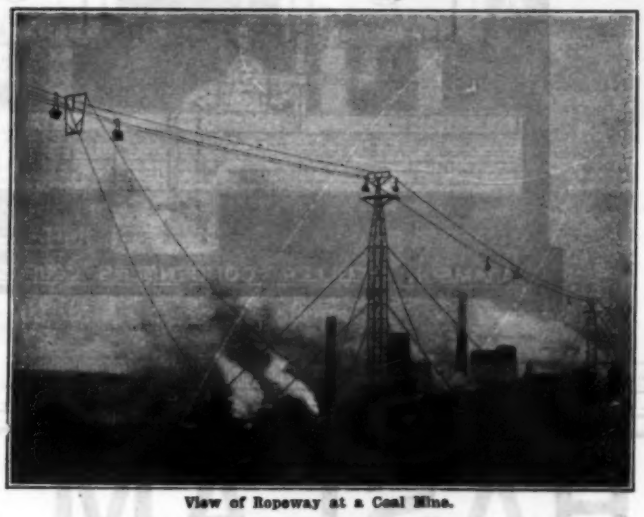

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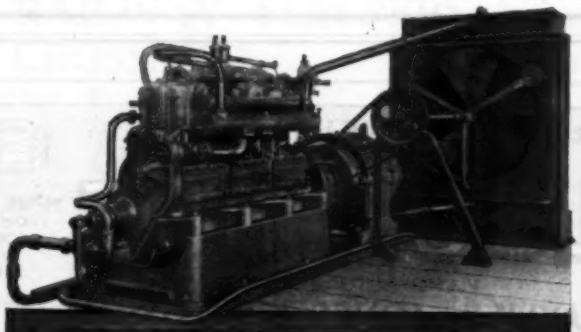

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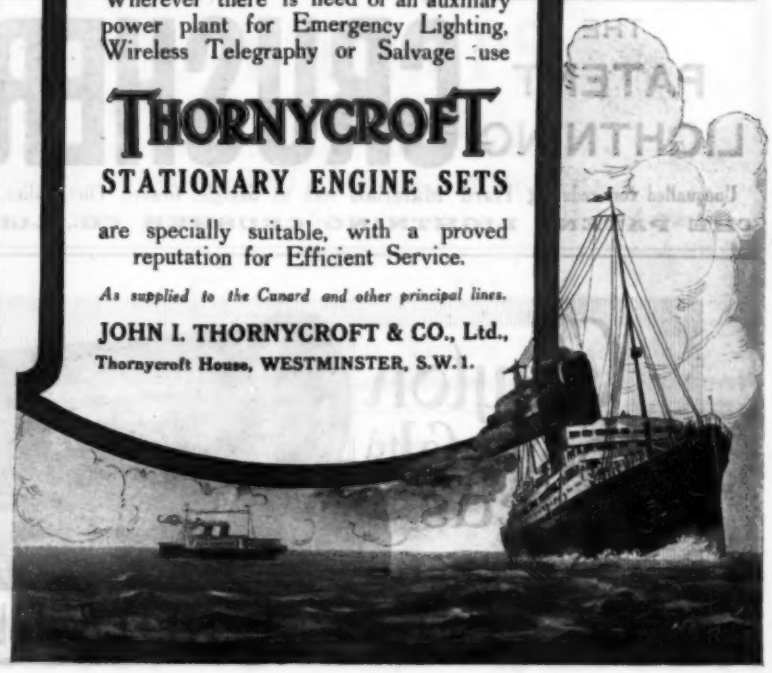

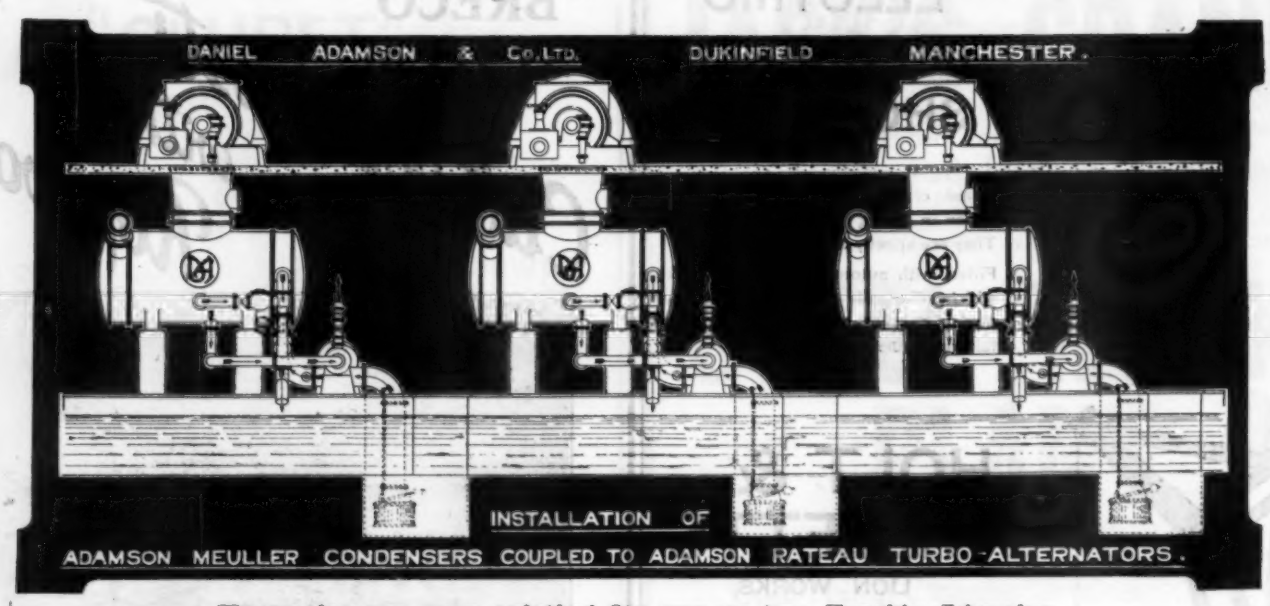
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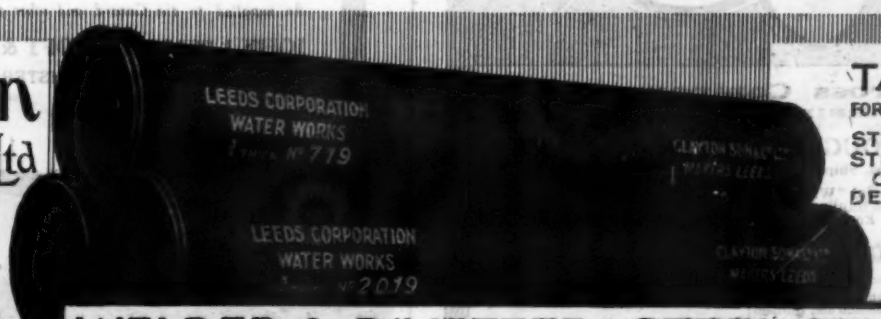

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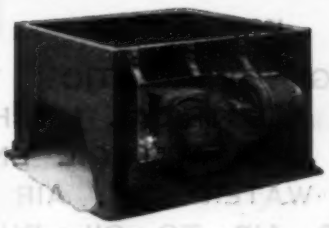

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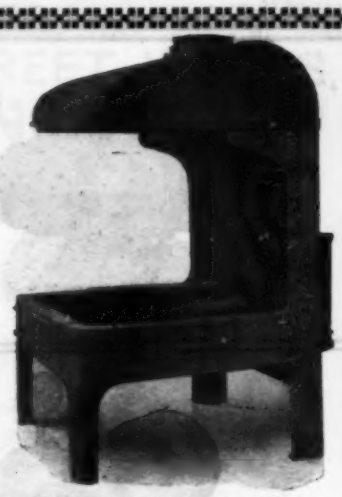

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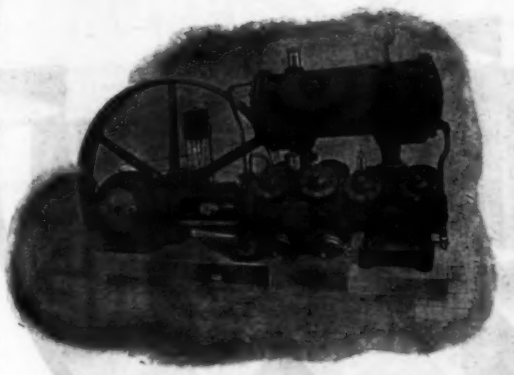

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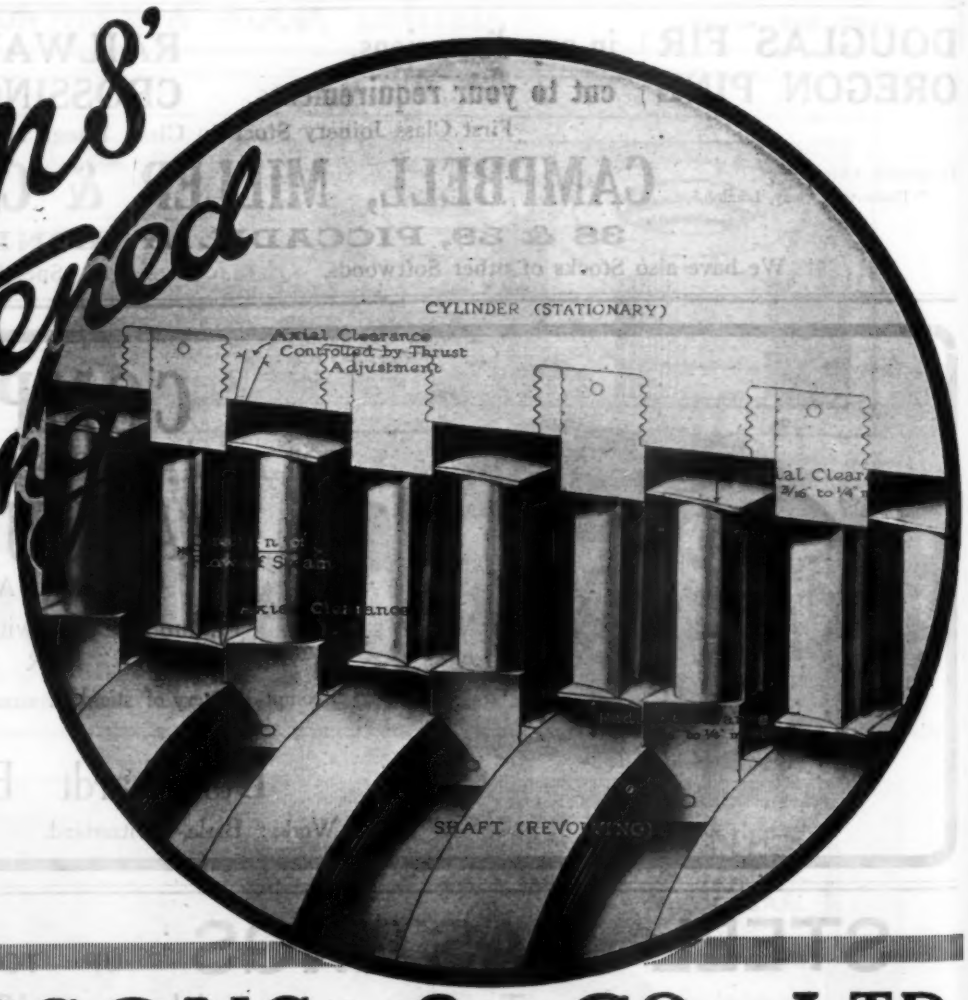

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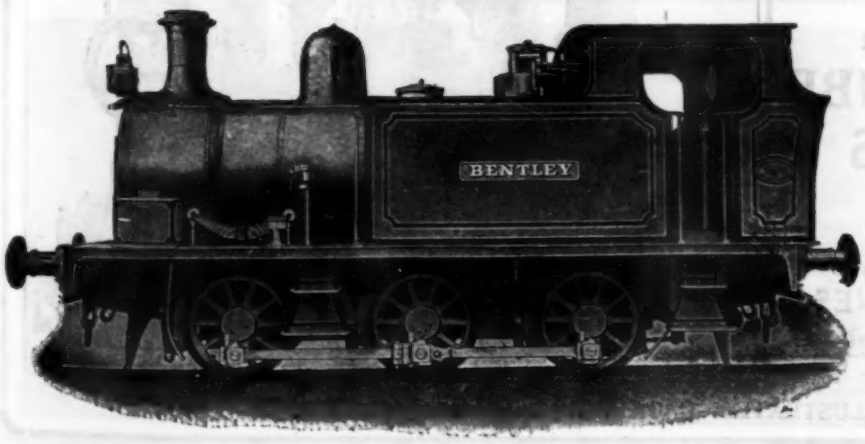

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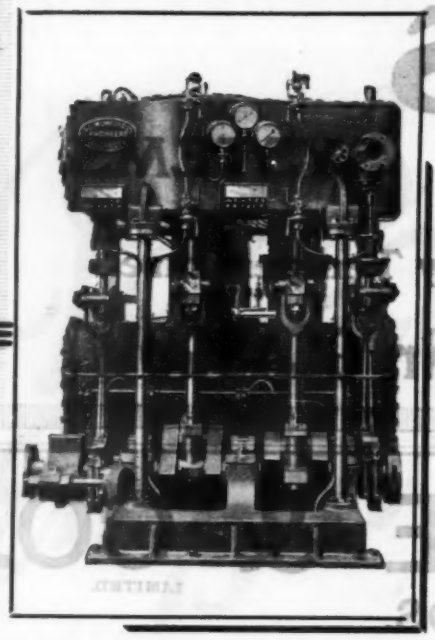

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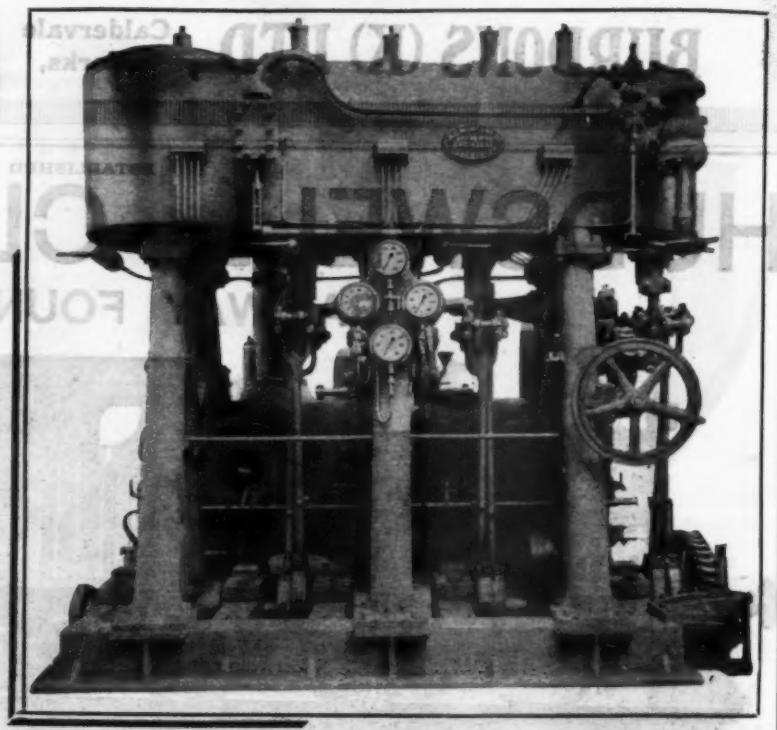

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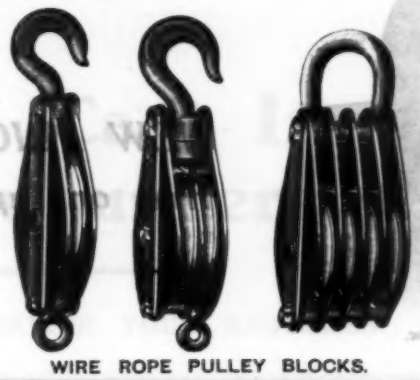

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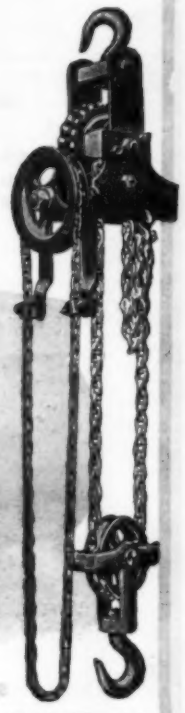

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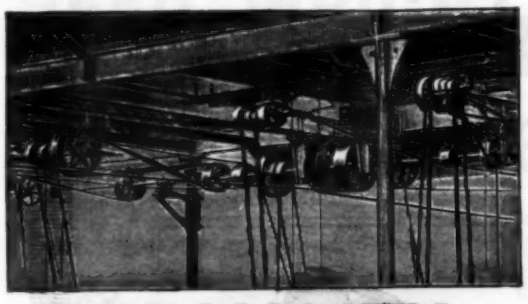

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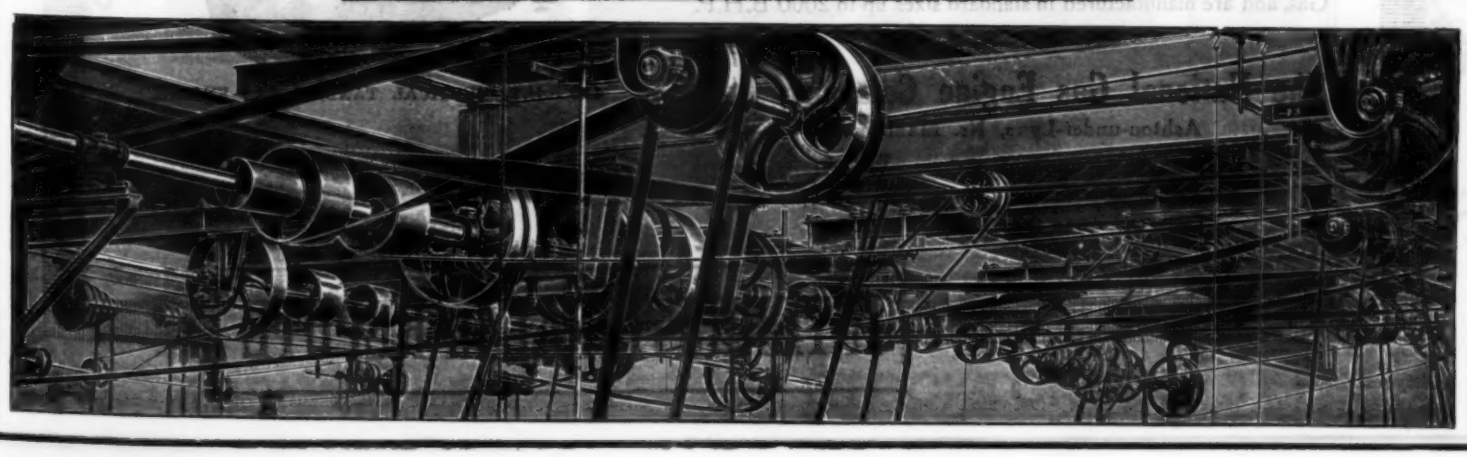

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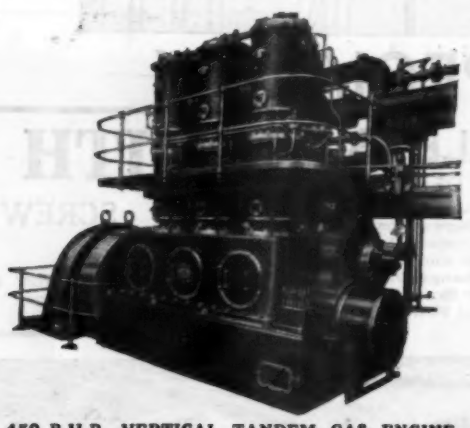

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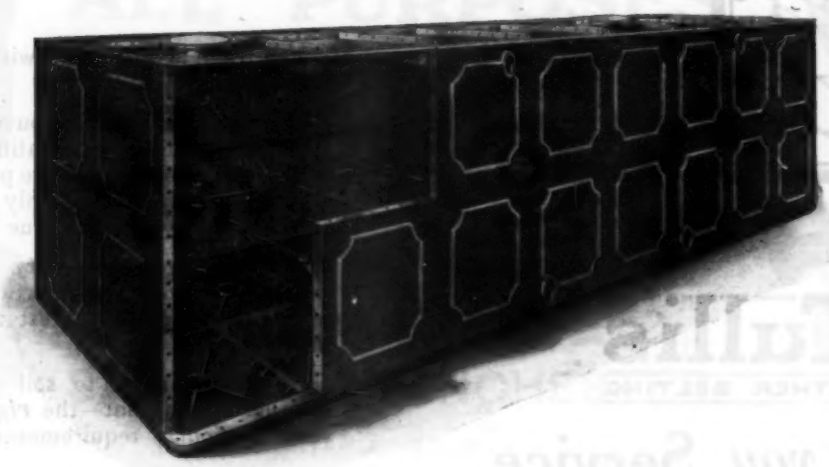

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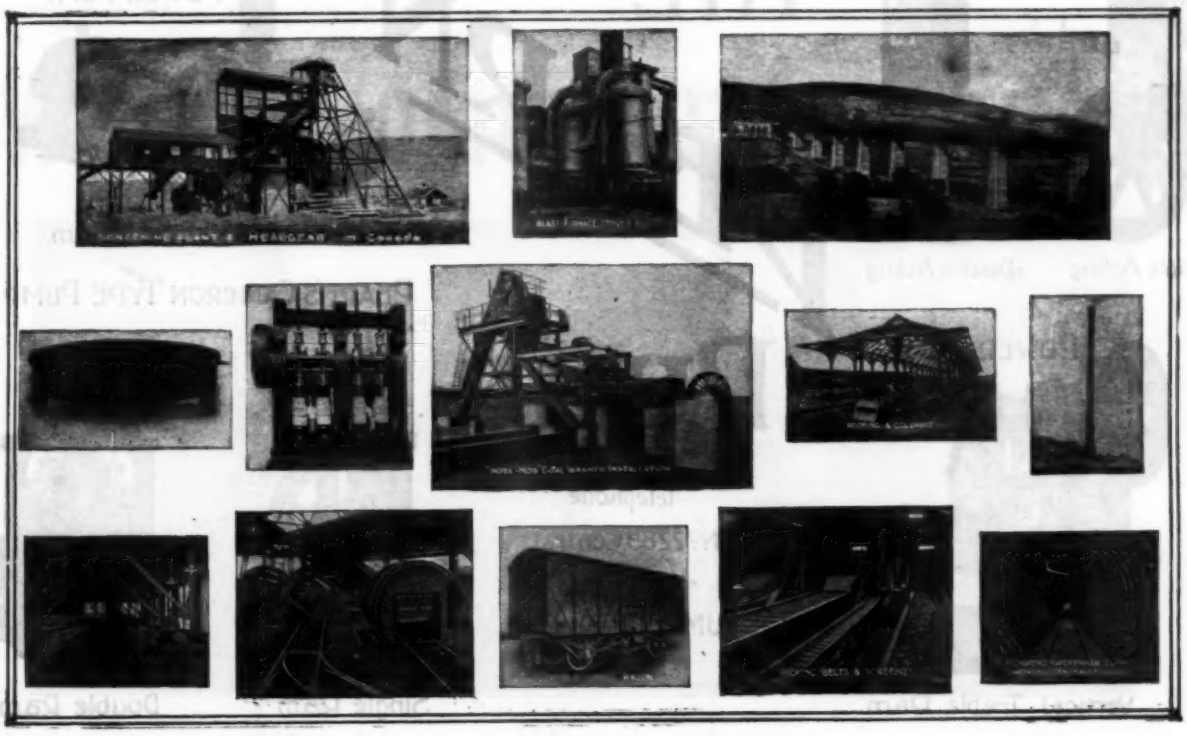

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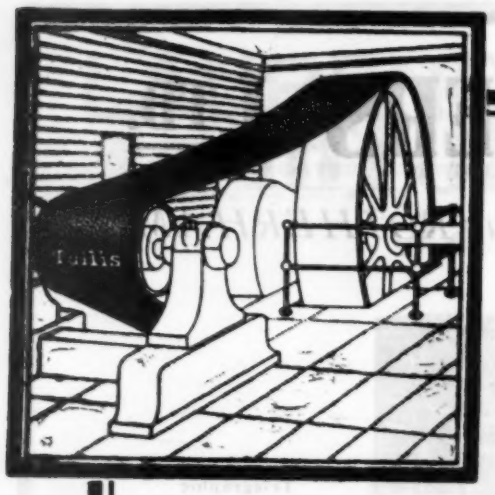

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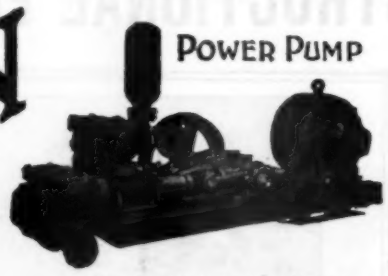

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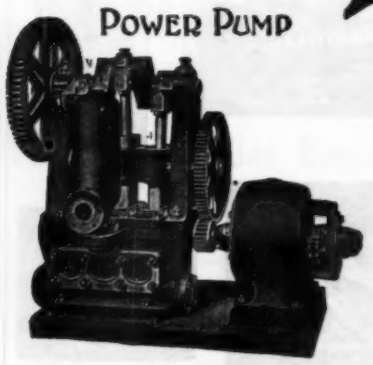

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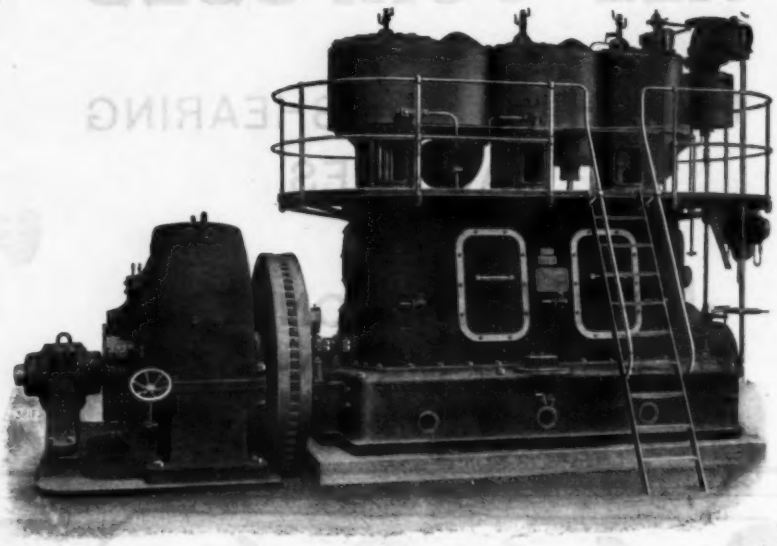

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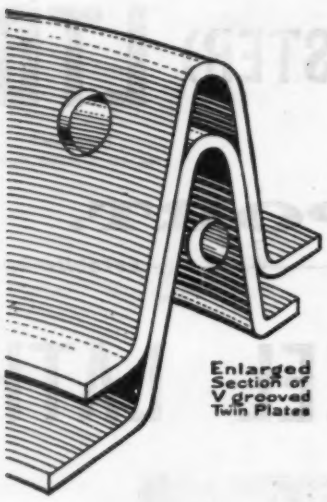

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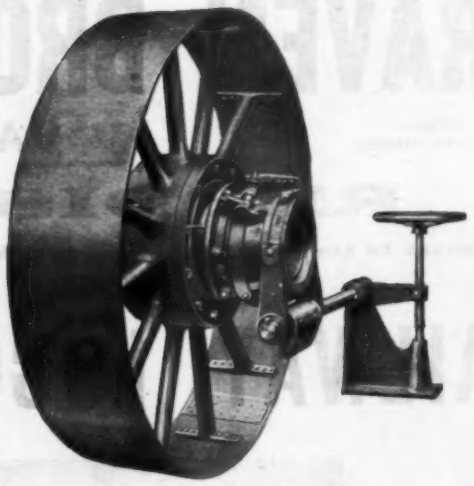

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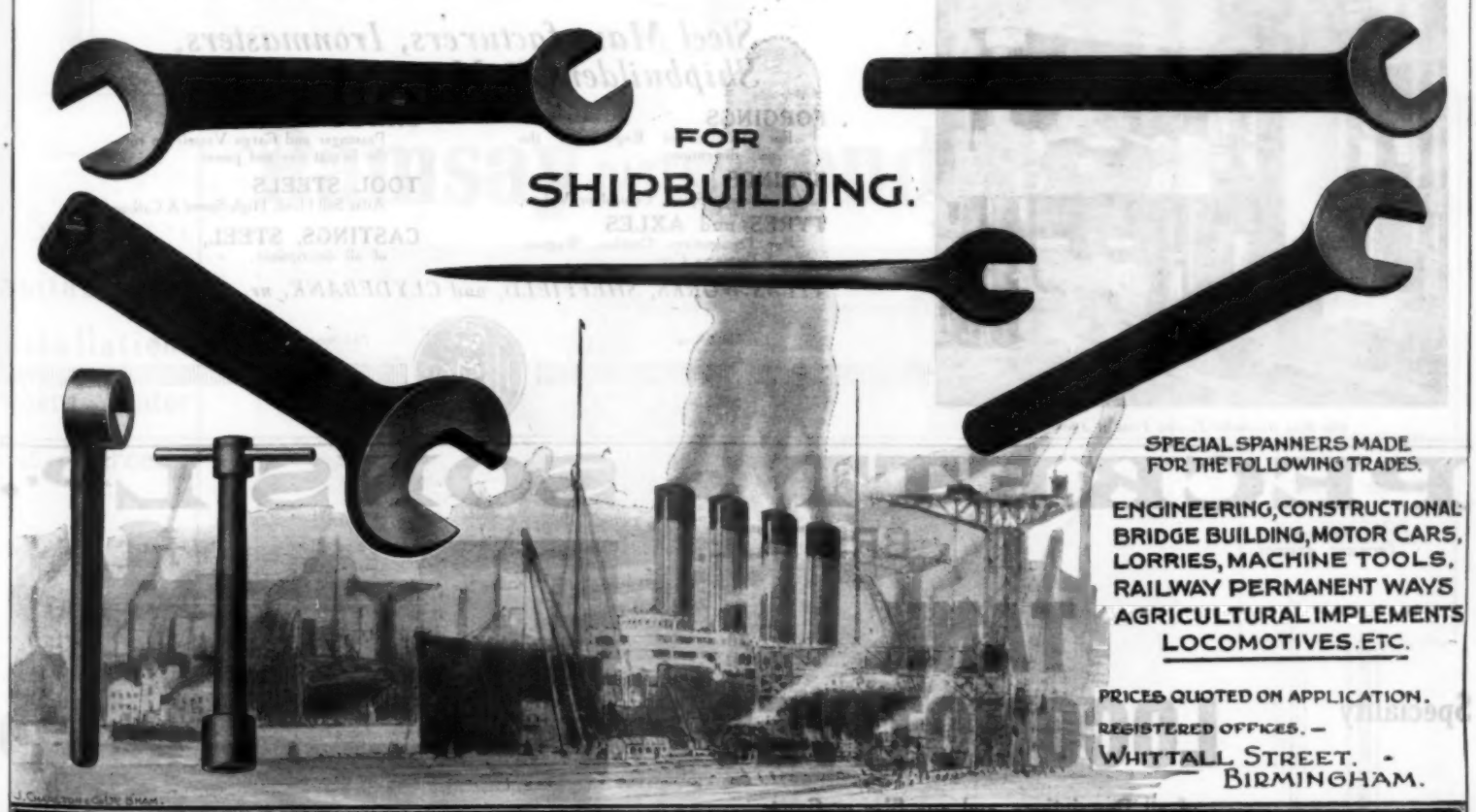

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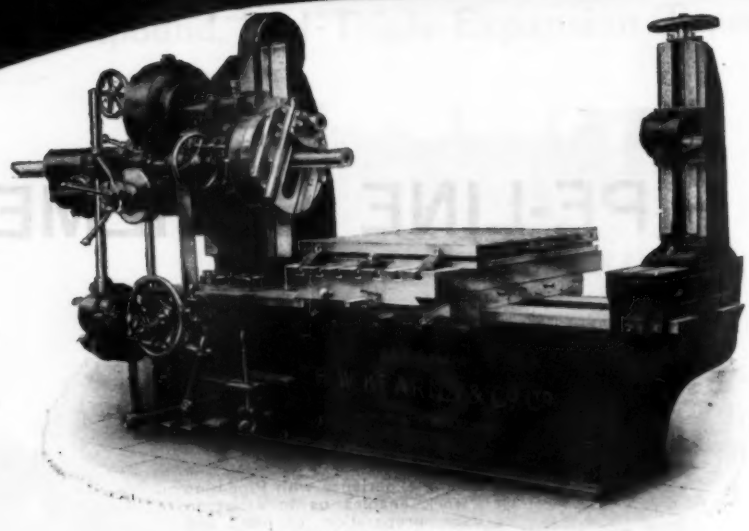

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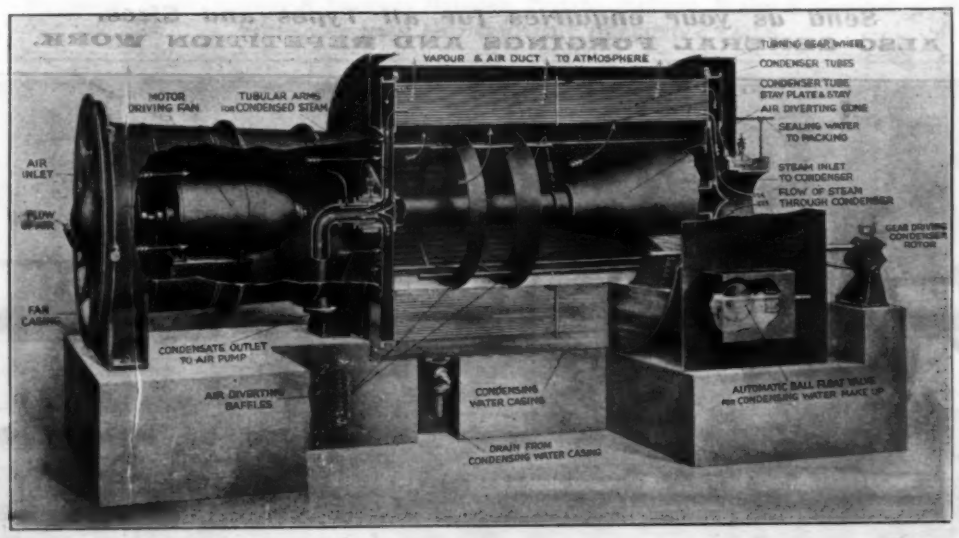
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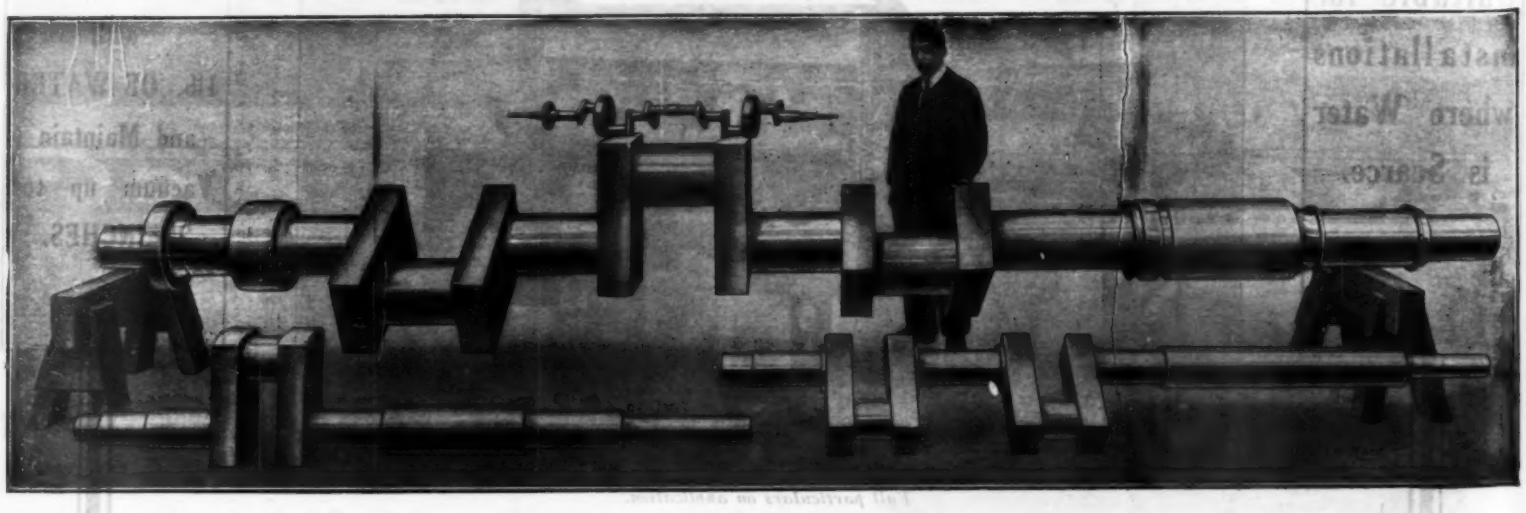

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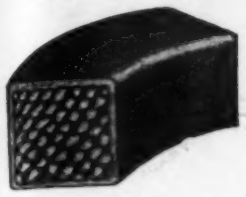

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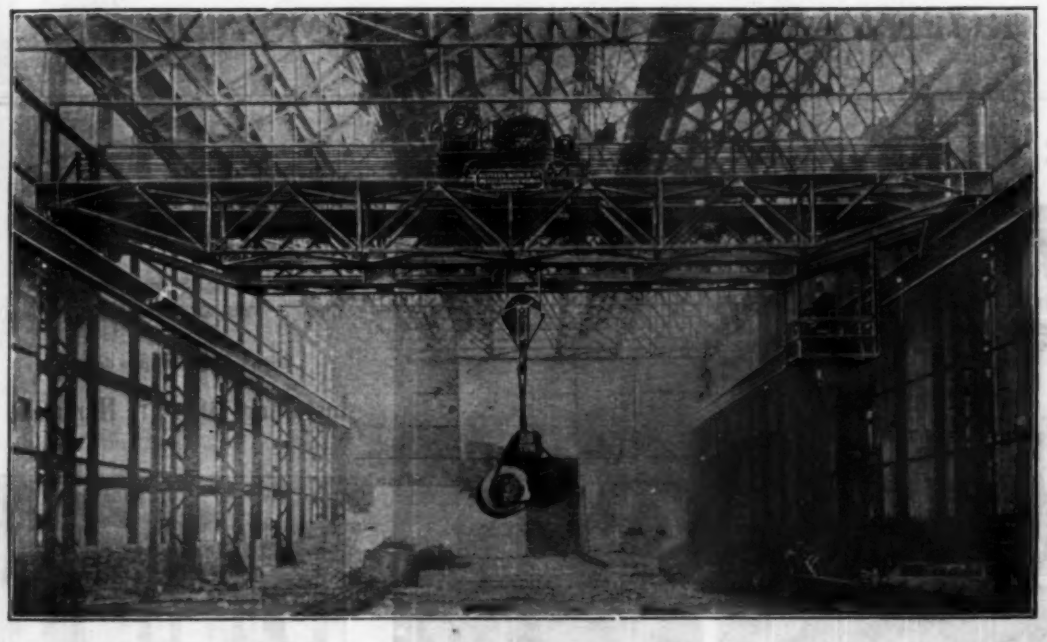

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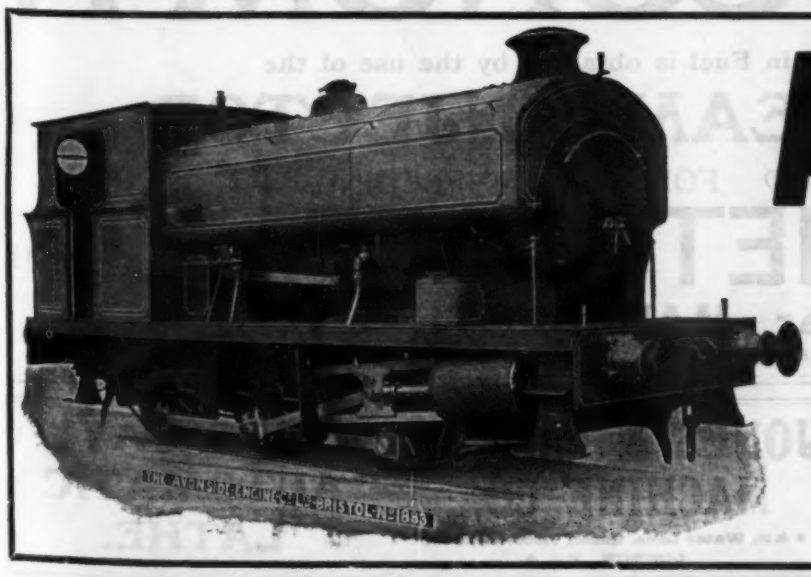

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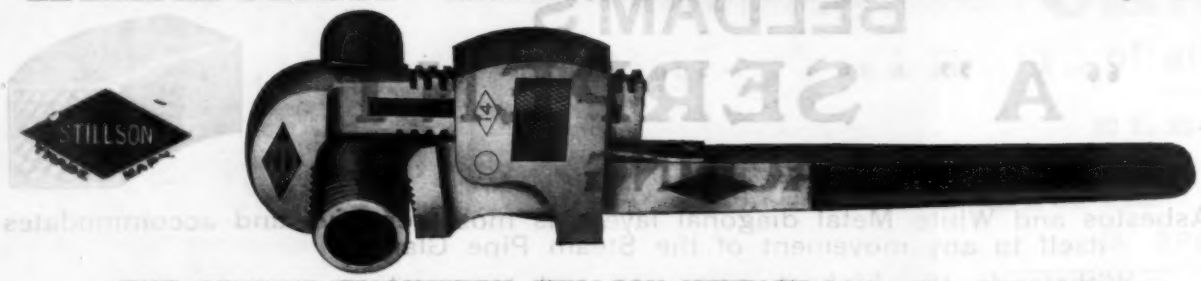

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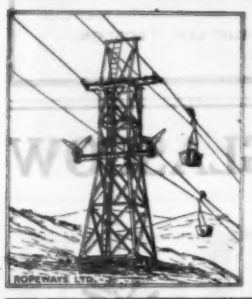

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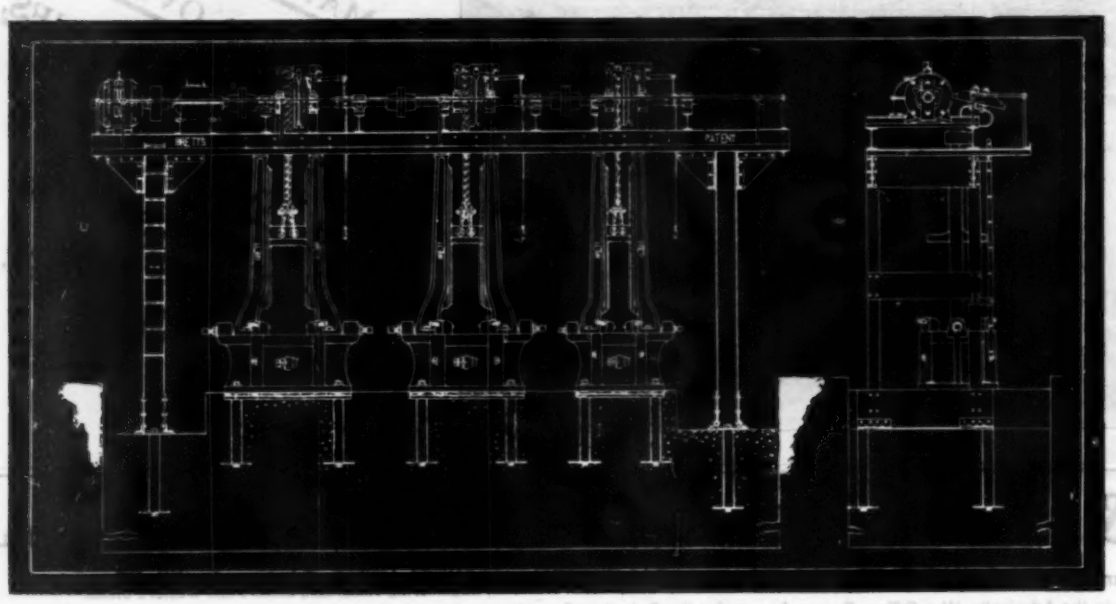

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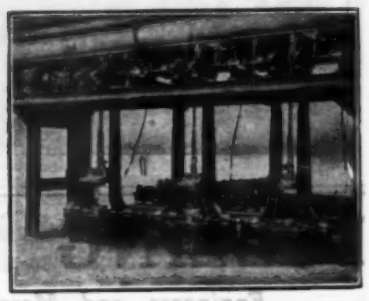

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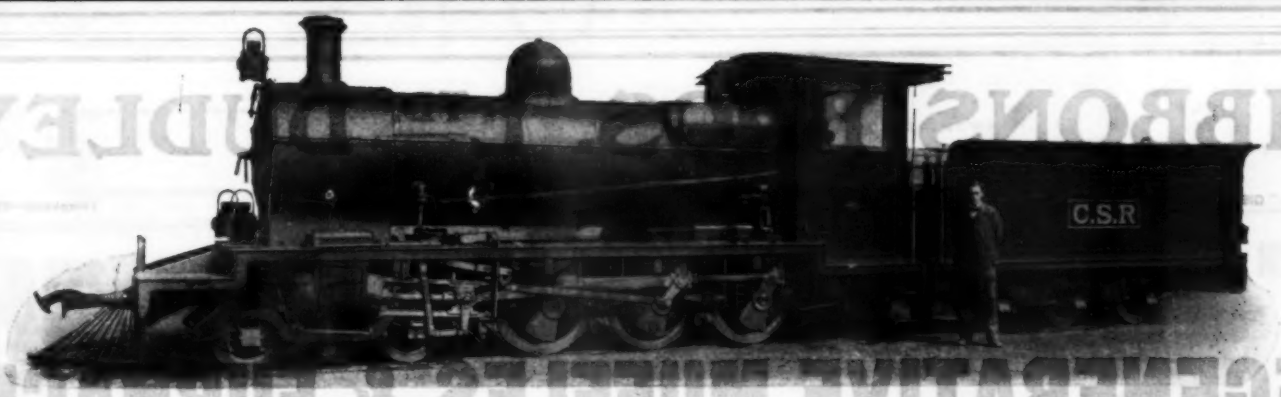

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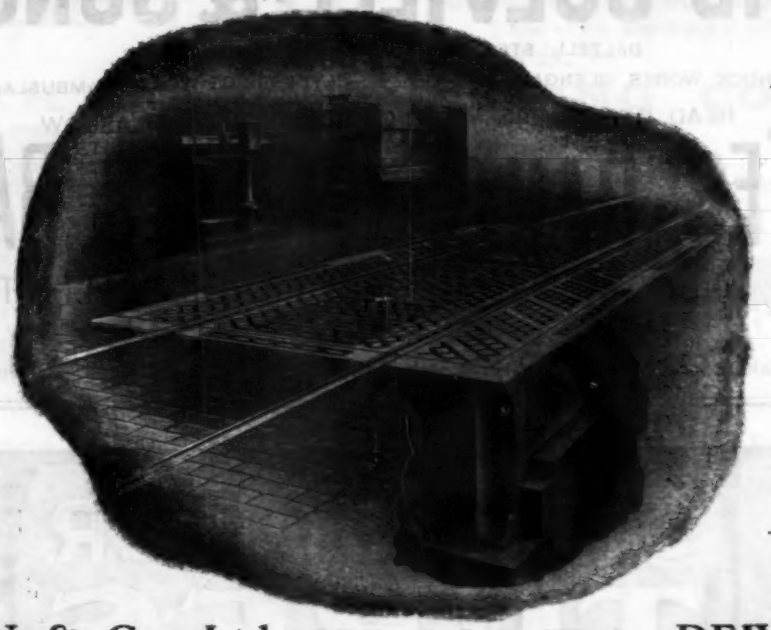

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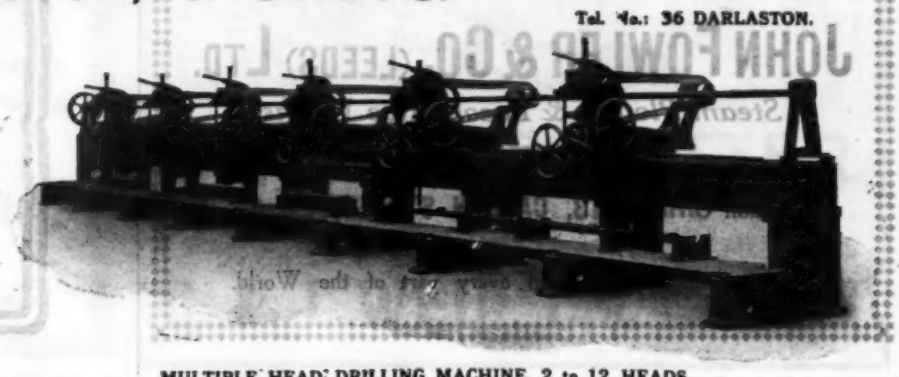

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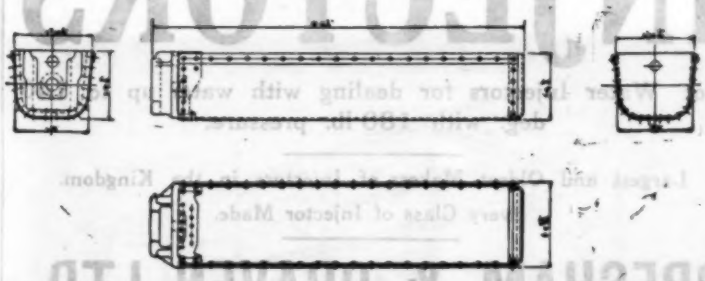

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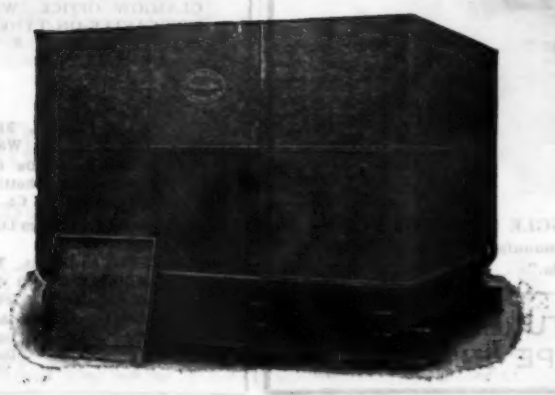

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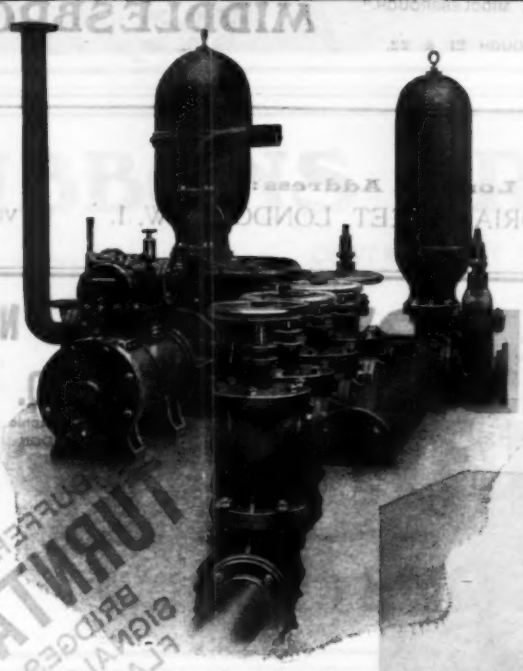

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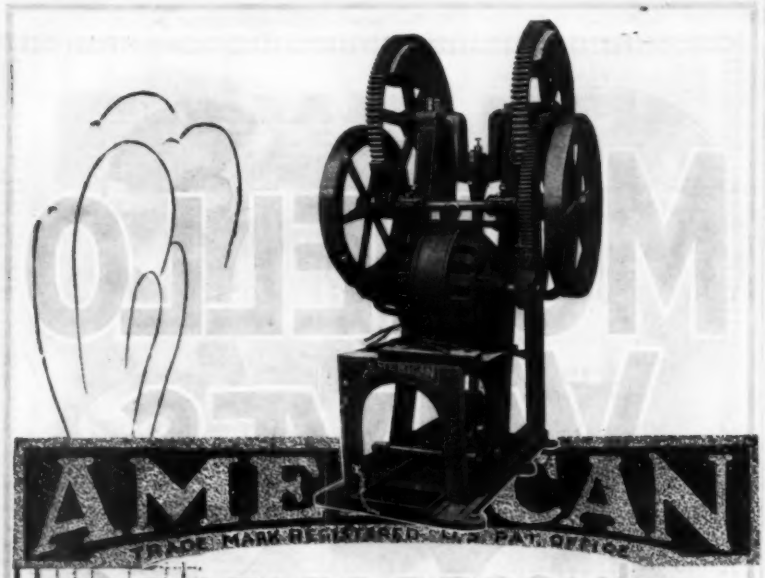

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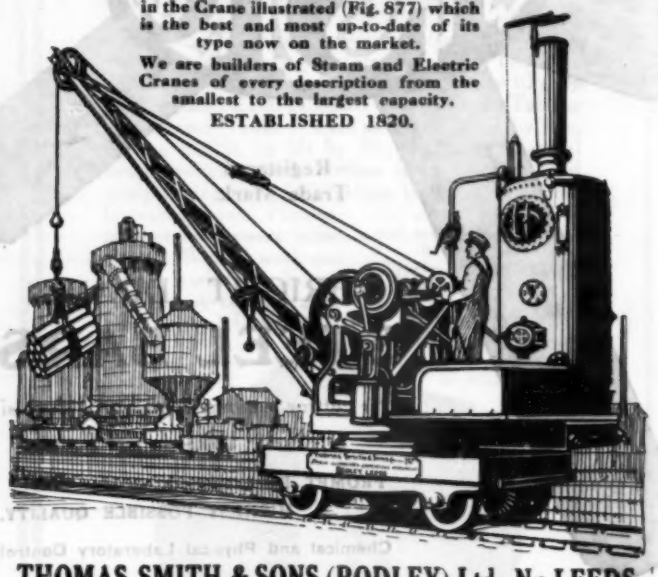

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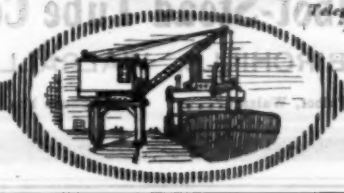

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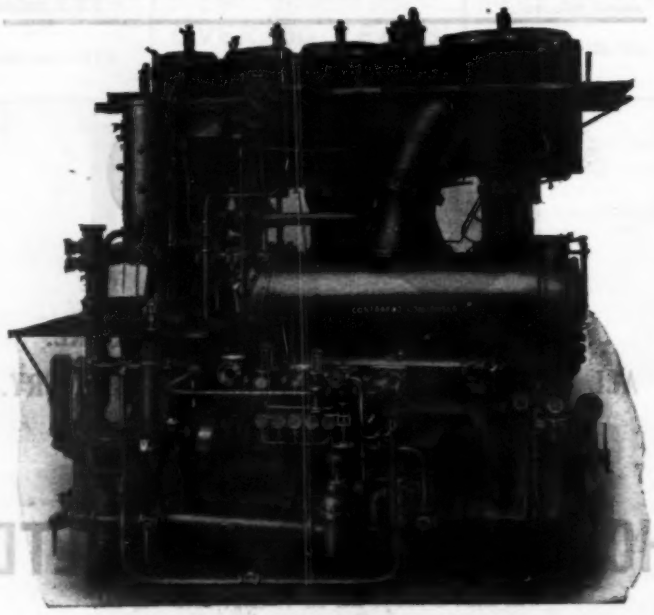

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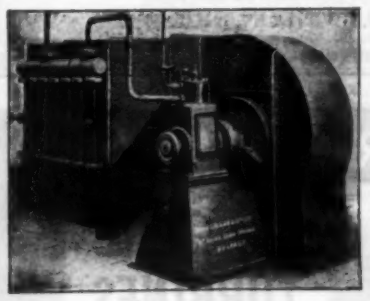

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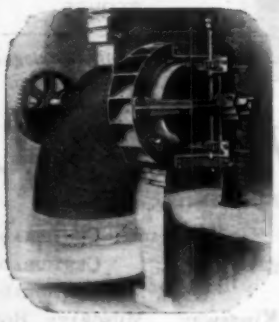

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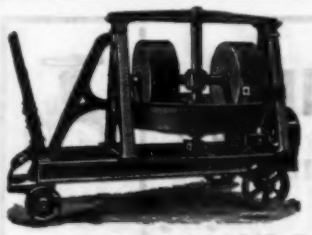

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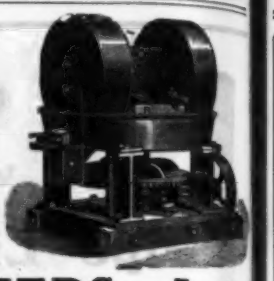

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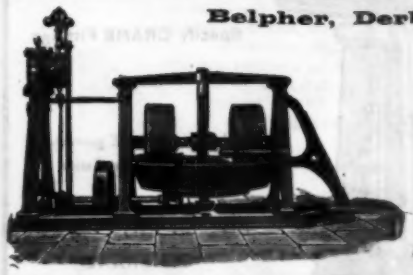

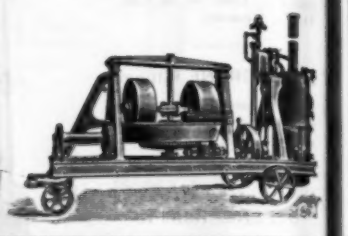

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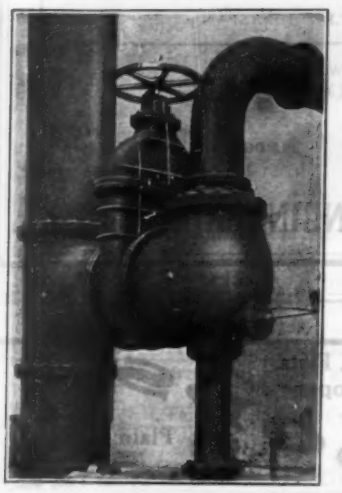

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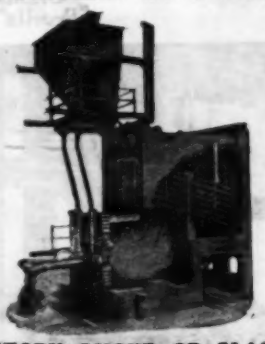

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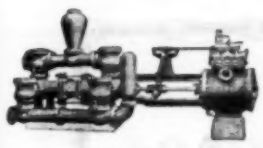

Fig. 1071.

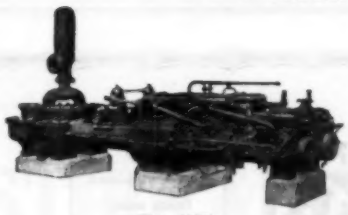

Fig. 1430.

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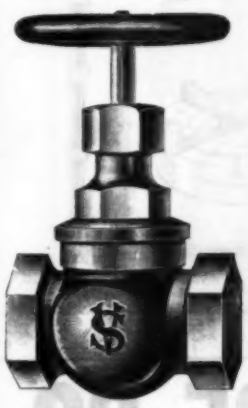

Fig. 9
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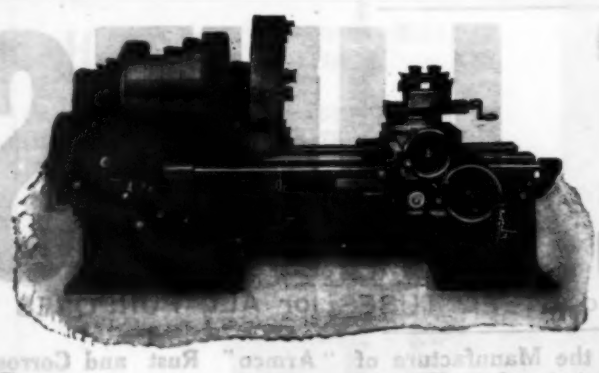

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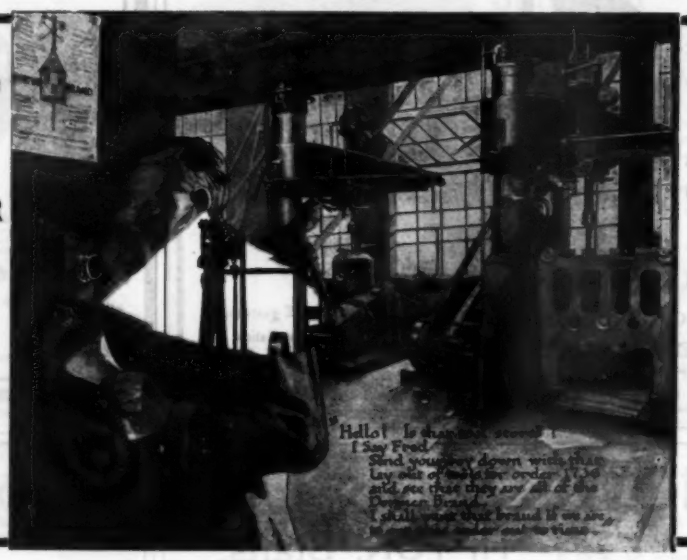

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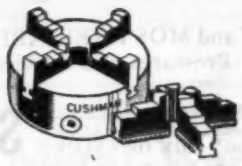

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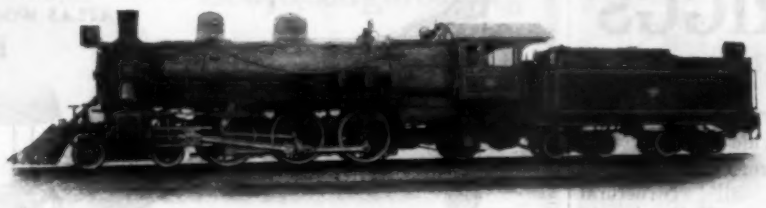

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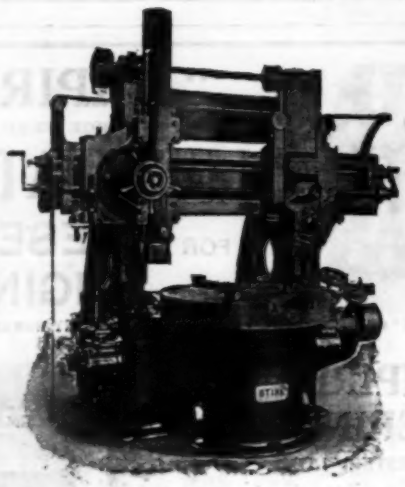

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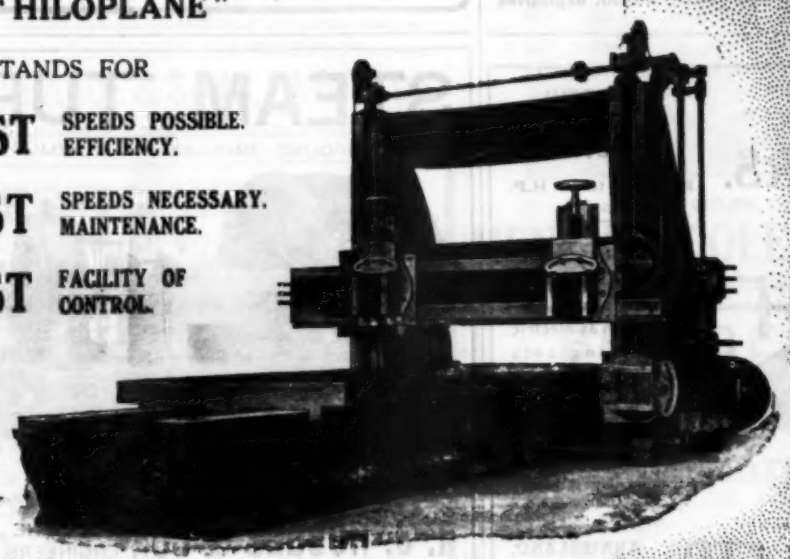

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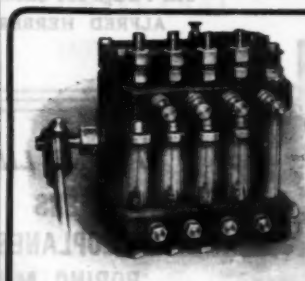

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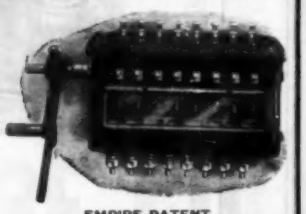

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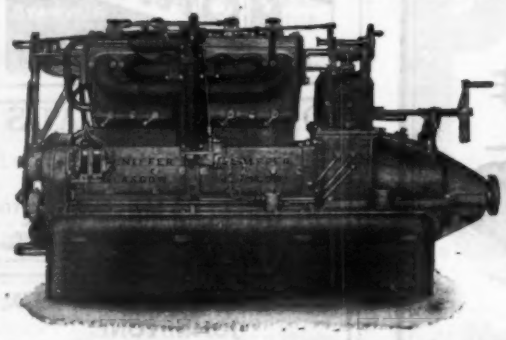

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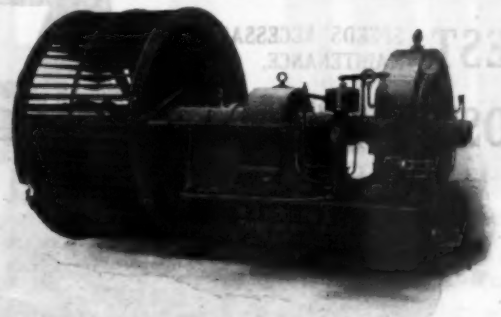

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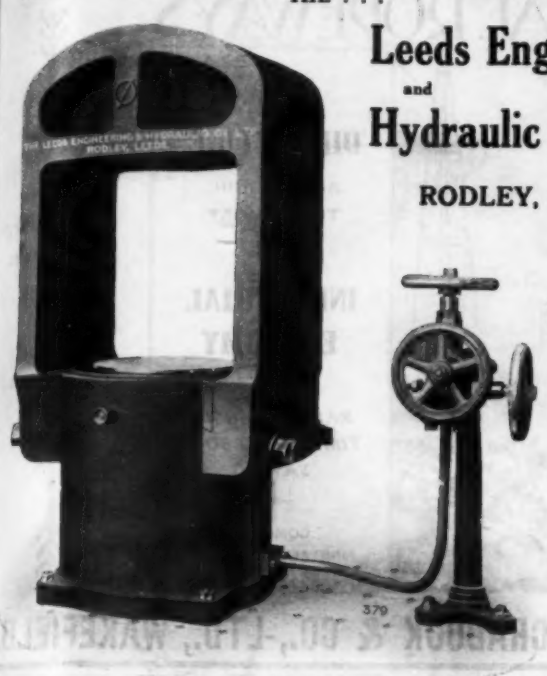

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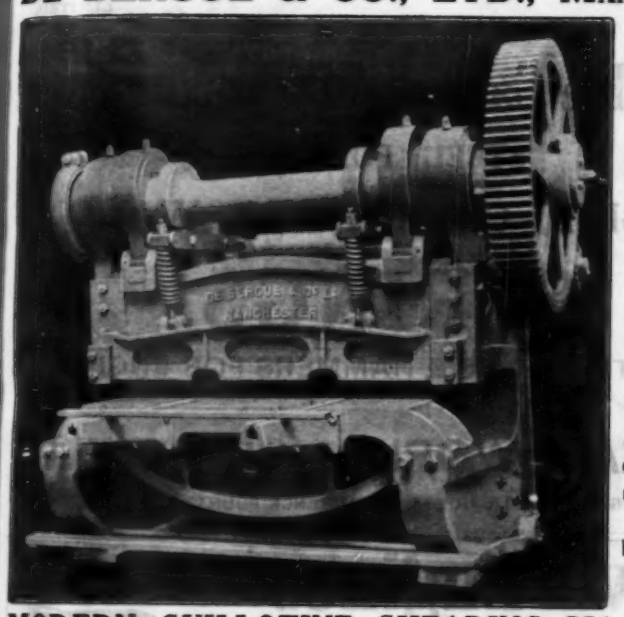

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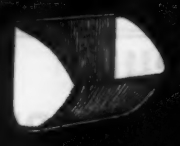

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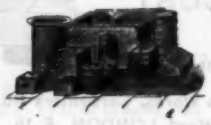

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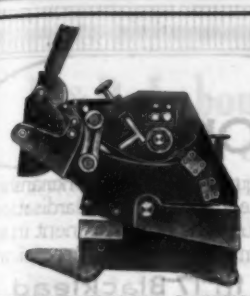

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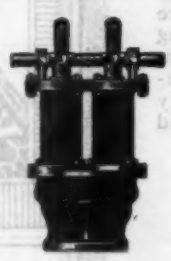
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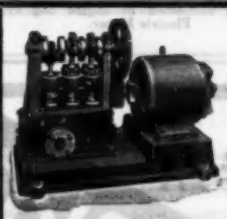
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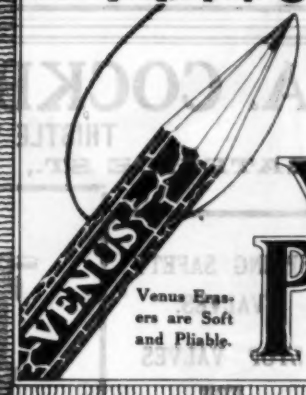

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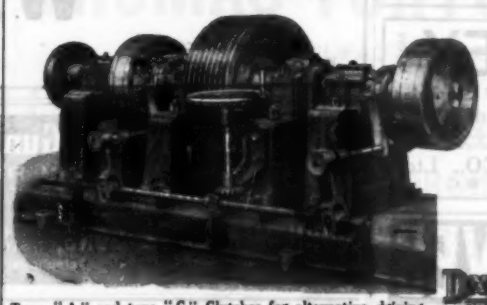

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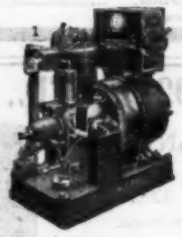
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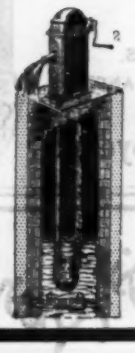
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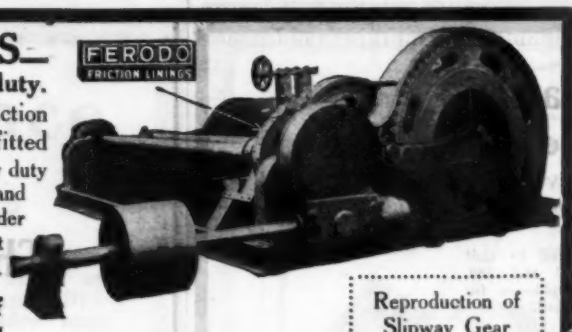

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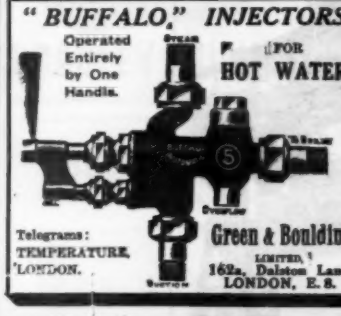

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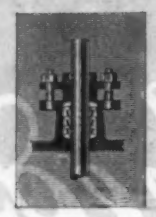

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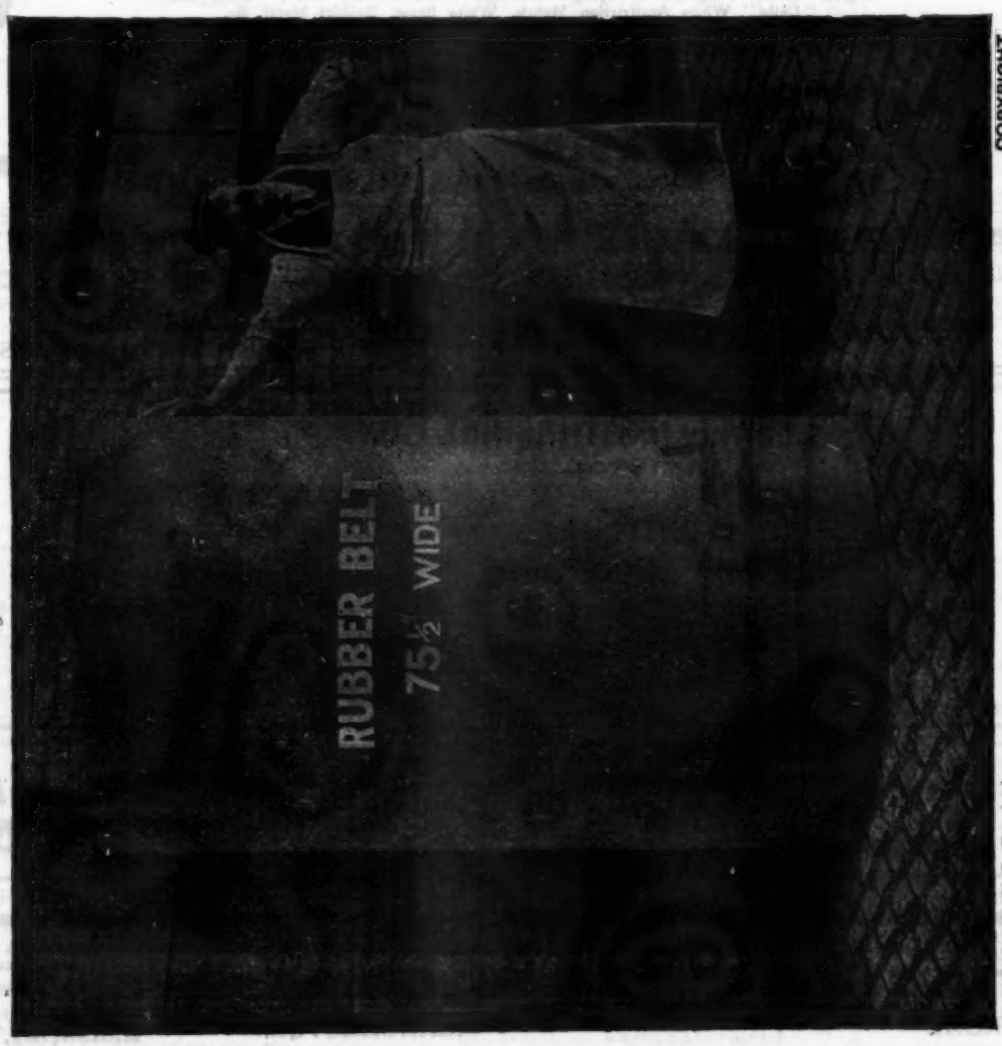

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INDEX TO ADVERTISEMENTS.

	PAGE
Adamson, D., & Co., Lt.	62
Alexander, R. F., & Son	61
Allan, T., & Sons, Ltd.	84
Allen, Whyte & Co.	84
Alldays & Onions, Ltd.	67
Allen-Liversidge Ltd.	57
Allen, W. H., Sons & Co., Ltd.	49
American Well Works	84
American Pencil Co.	94
Anderson-Grice Co., Ltd.	60
Anderston Foundry Co., Ltd.	34
Archdale, J., & Co., Ltd.	14
Armfield, J. J., & Co., Ltd.	86
Armstrong, Stevens & Son	73
Armstrongs & Main, Ltd.	36
Ash, J., & Son	96
Ashworth, Son & Co., Ltd.	96
Asquith, W., Ltd.	3
Associated British Machine Tool Makers, Ltd.	14–15
Aster Engineering Co., Ltd.	43
Avonside Engine Co., Ltd.	77
Bagnall, W. G., Ltd.	78
Bagshawe & Co., Ltd.	25
Bagshaw, J., & Sons, Ltd.	4
Bain, W., & Co., Ltd.	34
Bakers (Leeds) Ltd.	34
Baldwin Locomotive Works	80
Barnis, W., & Sons	87
Batchelor, R. D.	7
Baxter, W. H., Ltd.	108
Baylis, Jones & Baylis	62
Beardmore, W., & Co., Ltd.	83
Beebee, A.	60
Beldam Packings Rubber Co	77
Bellias & Morcoms, Ltd.	72
Bennett & Sayer	34
Bennis, Ed., & Co., Ltd.	31
Borgius Launch & Engine Co	92
Berry, F., & Sons	34
Bertrams Limited	34
Beyer, Peacock & Co Ltd	51
Birmingham Battery & Metal Co	56
Blakeborough, J., & Sons	46
Bliss, E. W., Co	95
Boby, W., & Son	96
Bolling & Lowe, Ltd.	77
Boulson & Paul, Ltd.	96
Boving & Co., Ltd.	80a
Boyle, Scott, & Son	51
Braby, F., & Co., Ltd.	61
Brackett, F. W., & Co., Ltd.	34
Bradley Pulverizer Co	94
Bradley's Foundry	100
Braithwaite & Co., Ltd.	22
Brett's Patent Lifter Co., Ltd.	78
Bridge, D., & Co., Ltd.	94
Briggs, W., & Sons, Ltd.	90
Briquette Machinery Ltd.	34
Brit. Reinforced Asbestolite Wks.	89
Brit. Role-Shaw Chuck Co.	72
British L. M. Ericsson Manufacturing Co., Ltd.	39
Brit. Mannesmann Tube Co.	28
Brit. Nickanese Boiler Co., Ltd.	6
British Oxygen Co., Ltd.	85
British Ropeway Eng. Co.	61
Brit. Steam Specialties, Ltd.	34
British Steel Piling Co.	24
Brit. Thomson-Houston Co.	39
Brocklebank, R., & Son, Ld.	6
Brock, A., & Co.	3
Broom & Wade, Ltd.	37
Broughton Copper Co., Ltd.	92
Brown, J., & Co., Ltd., Sheff'd	74
Brown, W. R., & Co.	7
Browning, W. R., & Co.	6
Brownlie & Murray, Ltd.	6
Bruce Peebles & Co., Ltd.	19
Buckton, J., & Co., Ltd.	100
Bucyrus Company	94
Budenberg Gauge Co., Ltd.	96
Bull's Metal & Melloid Co., Ltd.	51
Burckhardt Eng'g Works	63
Burdons, Limited	66
Burley & Son, Ltd.	6
Butcher, H., & Co.	107
Butler, S., & Co., Ltd.	10
Butterfield, W. P., Ltd.	92
Butters Bros. & Co.	77
Cameron, J., Ltd.	71
Cammell, Laird & Co., Ltd.	100
Campbell, Miller & Campbell	63
Campbells & Hunter, Ltd.	100
Carels Diesel & Steam Engines (London), Ld.	51–99
Chambers, Scott & Co. Ld.	96
Churchill, C., & Co.	34–56
Clarkson	3
Clayton, Goodfellow & Co.	4
Clayton, Son & Co., Ltd.	62
Clayton Wagons, Ltd.	95
Cleveland Bridge & Engineering Co.	56
Clews, Peterson & Co.	60
Clifton & Waddell	96
Clyde Structural Iron Co., Ltd.	83
Clyne Engineering Co., Ltd.	6
Coan, Robert W.	93
Cockburn, A., & Co.	95
Cockburns Limited	96
Coil Clutch Co., Ltd.	6
Coles, H. J., Ltd.	91
Colvilles, D., & Sons, Ltd.	79
Consolidated Brake & Eng. Co.	6
Consolidated Pn'tic Tool Co.	18
Conveyor & Elevator Co.	7
Cooke, W., & Co., Ltd.	71
Coventry Chain Co.	68
Cradock, G., & Co., Ld.	98
Crane-Bennett Limited	85
Craven Bros. (Manch'ter) Ltd.	71
Crompton & Co., Ltd.	48
Cronite Foundry Co., Ltd.	18
Cushman	88
Daniels, T. H. & J., Ld.	93
Danks, H. & T., Ltd.	10
Darlington Forge Co., Ltd.	78
Davey, Paxman & Co., Ltd.	50a
Davidson & Co., Ltd.	21
Davie & Horne	86
Davies & Metcalfe, Ltd.	76
Davies, T., & Son	10
Davy Bros., Ltd.	82
De Bergue & Co., Ltd.	91
Dekterieff, L.	5
Delta Metal Co., Ltd.	93
Denison, S. & Son, Ltd.	10
Douglas, Lawson & Co.	56
Drewry Car Co., Ltd.	45
Drum Engineering Co.	6
Drummond Bros., Ltd.	9–93
Drysdale & Co., Ltd.	45
Dunglinson, S.	63
Dunlop & Ranken, Ltd.	23
Dunlop Rubber Co., Ltd.	58
Dyson & Co., Ltd.	5
East Ferry-road Engin'g Co.	10
Easton & Anderson	98
Eclipse Fuel Co.	87
Edison Swan Electric Co.	3
Electric Control Limited	6
Ellis & Sons	100
Ellison, G.	44
Empire Engineering Co., Ld.	90
Ewart Chainbelt Co., Ld.	62
Ferguson Brothers, Ld.	7
Ferodo Limited	96
Ferranti, Ltd.	44
Fielding & Platt, Ld.	38
Findlay, Alex., & Co.	91
Firth T., & Sons, Ld.	16
Fletcher Mallealble Foundries	91
Foster, J., & Sons	16
Foster, W., & Co., Ld.	3
Fowler, J., & Co. (Leeds), Ld.	52
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Fraser & Chalmers Eng'g Co.	53
Fraser, D., & Sons, Ld.	6
Fulham Bronze Co., Ld.	79
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Fullerton, Hodgart & Barclay, Ld.	75
Fuller, Horsey, Sons & Cassell	100
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Garrett, R., & Sons, Ld.	39
General Electric Co., Ld.	53
Gibbins, R. C., & Co.	6
Gibbons Bros., Ld.	80
Gibbs, John, & Sons	96
Gillespie Partners, Ld.	18
Gilman, Frank	8
Glasgow Railway Eng. Co.	91
Gleniffer Motors Limited	90
Glover, M., & Co.	51
Goldsborough Patents Co.	4
Goodall, Clayton & Co., Ld.	93
Goodwin, Barsby & Co.	86
Gordd, Lewis Wm.	51
Grafton & Co.	90
Grantham Boiler & Crank Co.	6
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Green & Houlding, Ld.	96
Greenwood's Gear Cutting Co.	10
Grenham & Craven, Ld.	62
Griffiths, William H.	8
Grover & Co., Ld.	61
Gunther, W., & Sons	6
Gwynnes Eng'g Co., Ld.	83
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Haldan, J., & Co., Ltd.	96
Hall, B. J., & Co., Ld.	41
Hall, J. & E., Ld.	51
Hamworthy Engineering Co.	85
Harpers Limited	28–100
Harris & Mills	51
Harrison & Camm, Ld.	51
Harvey, G. & A. Ld.	6
Haslam Foundry & Eng. Co., Ld.	62
Hattersley Bros., Ld.	69
Hawthorn, Leslie & Co.	8–100
Hayward-Tyler & Co., Ltd.	82
Head, Wrightson & Co., Ld.	69
Heaily-Grenham Eng'g Co.	7
Henderson, J. M., & Co.	40
Hendry, J.	90
Herbert, A., Ltd.	10
Hill & Smith, Ltd.	60
Hobsbill, Way & Co., Ld.	68
Hodges, R. J., & Co.	90
Holdsworth & Sons, Ld.	83
Hollings & Guest, Ld.	9
Holmes, J. H., & Co.	88
Holst, K., & Co.	8
Holt & Willetts	61
Horseley Bridge & Eng'g Co.	85
Howell & Co., Sheffield	79
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Hudson, T., Ld.	6
Hudswell, Clarke & Co.	55
Hull Forge Iron & Steel Co.	88
Hulse & Co., Ld.	51
Hunslet Engine Co., Ld.	100
Hunton, C. A., & Sons	93
Hurst Nelson & Co., Ld.	51
Ibos Ferro Co., Ltd.	100
Iles Foundry Co., Ltd.	81
Isles Limited	76
Jack, A., & Co.	60
Jackman, J. W., & Co., Ld.	6
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Jenkins, R., & Co., Ltd.	82
Johnson, W. F., & Co.	22
Jones & Lamson Machine Co.	78
Jones and Shipman, Ltd.	3
Jones, George, Ltd.	6
Kearns, H. W., & Co., Ltd.	79
Keith & Blackman Co., Ld.	62
Kent, George, Ltd.	95
Kenyon, W., & Sons, Ltd.	8
Kirkaldy, J., Ltd.	68
Kirk, Price & Co.	2–100
Klinger Patents	43
Korting Bros. (1917), Ltd.	88
Krupp Ltd. Metal Works, Ltd.	42
Lang & Hebert, & Co., Ltd.	66
Lancaster & Tonge, Ltd.	87
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Lanston Monotype Corpn.	35
Laurence, Scott & Co., Ltd.	66
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Ledward & Beckett, Ltd.	92
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Less, T. & R., Ltd.	81
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Lobnitz & Co., Ltd.	60
Lockwood Crosby, & Son	100
London Electric Firm	93
London Bros., Ltd.	89
Macfarlane Engineering Co.	93
Macfellan, P. & W.	51
Manchester Furnaces Ltd.	82
Manning, Wardle & Co., Ld.	90
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Mumford, A. G., Ltd.	66
Munting, H., Ld.	79
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Neasi Industrial Collotians Ld.	22
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Newall, E., & Co., Ld.	51
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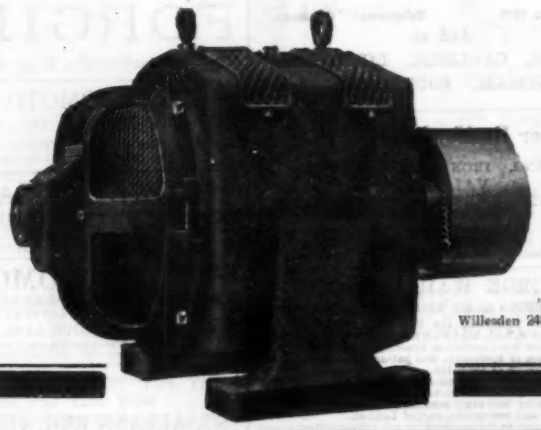

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